COMPUTING FOR BUSINESS AND HOME

INTERFACE AGE™

MARCH 1981

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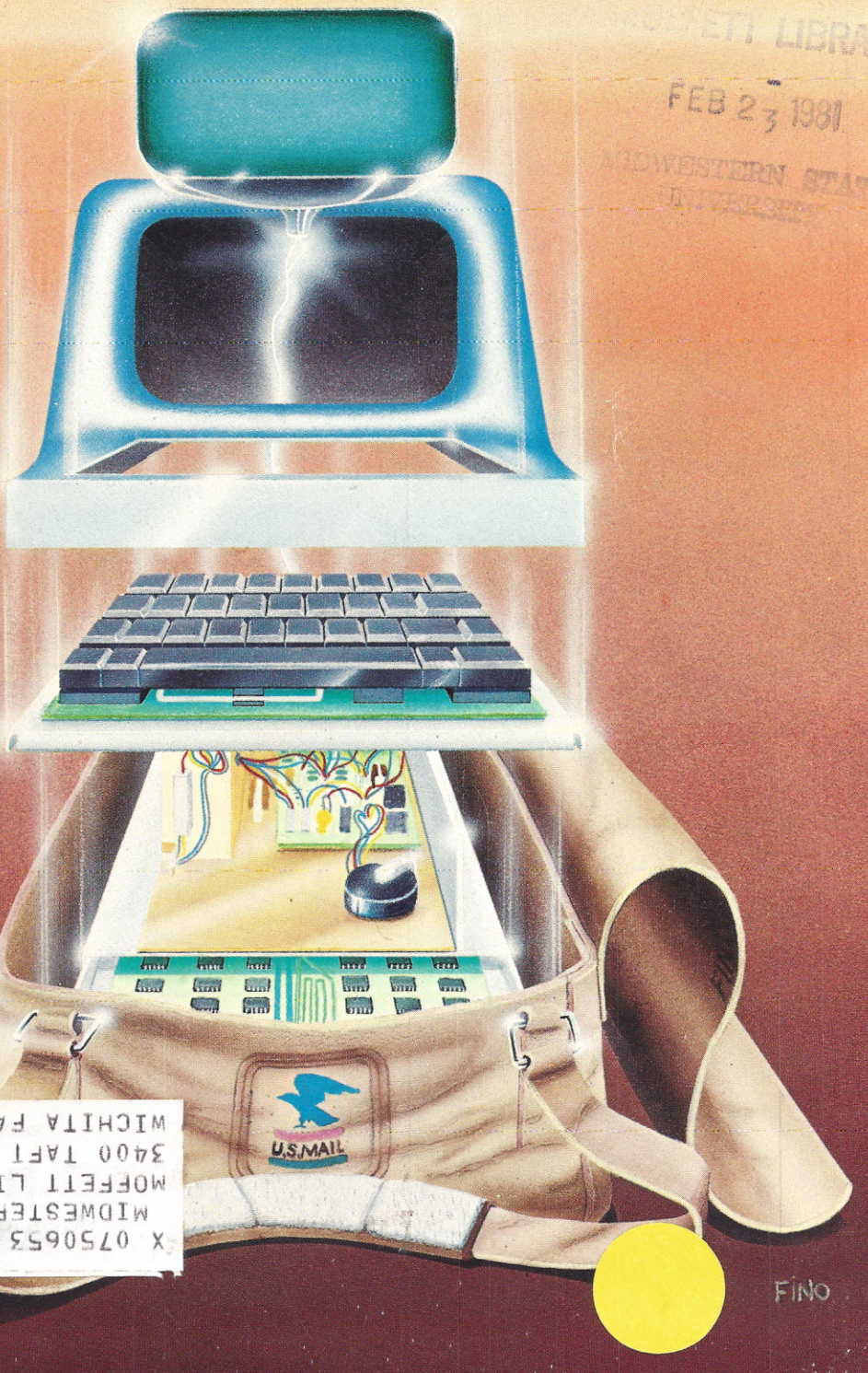
ARMCHAIR SHOPPING: Mail-Order Computers

Lease, Buy, Time Share, Pros & Cons

Exploring the OEM Market



"My computer helped me write The Final Encyclopedia. I wouldn't trust anything less than Scotch® Brand Diskettes to make a long story short."

Cover art by Michael Whelan, courtesy of Ace Publishing Co.

Gordon R. Dickson,
Science Fiction Author,
Minneapolis, Minnesota

Gordon Dickson: a small businessman whose product is his own imagination. He's written more than 40 novels and 150 short stories; his newest work is *The Final Encyclopedia*. He uses his personal computer and word processing software to maximize his production. All his words—his product—are stored on diskettes. He calls up sentences and paragraphs on demand, and gets more rewrite out of the time available. So he depends on Scotch diskettes to save himself production time.

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3M

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Yes, Data General, we saw your ad.

So we realize you hope to win over some of our computer business.

And we can see you have reason to be pleased about your line of minicomputers. They *are* MINIs though.

But Cromemco produces state-of-the-art MICROcomputers.

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And our micros have some outstanding advantages.

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That means, of course, that our customers have a wide choice of disk storage capability.

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- CROMIX (a UNIX-like operating system)
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- BASIC
- FORTRAN IV
- RATFOR
- LISP
- C
- Macro Assembler

APPLICATION SOFTWARE

- Word Processing System
- Data-Base Management
- General Ledger
- Accounts Receivable
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- Inventory

All of this is available now with more coming all the time.

So there you are, D.G.

You can see why we know our microcomputers will stand the test.

Cromemco eagerly accepts the challenge.

Reproduced from the July 31, 1980 issue of *Electronics* magazine.

Cromemco logo on computer board shown in original ad

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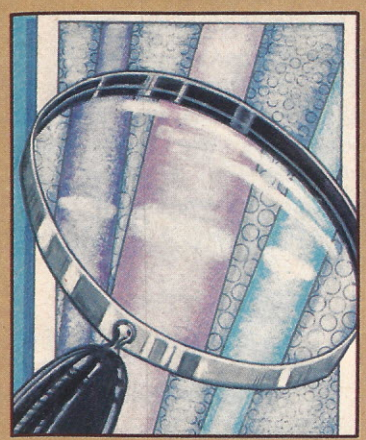

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Contact authors of monthly columns by writing to them at INTERFACE AGE, P.O. Box 1234, Cerritos, CA 90701 in care of their respective columns.

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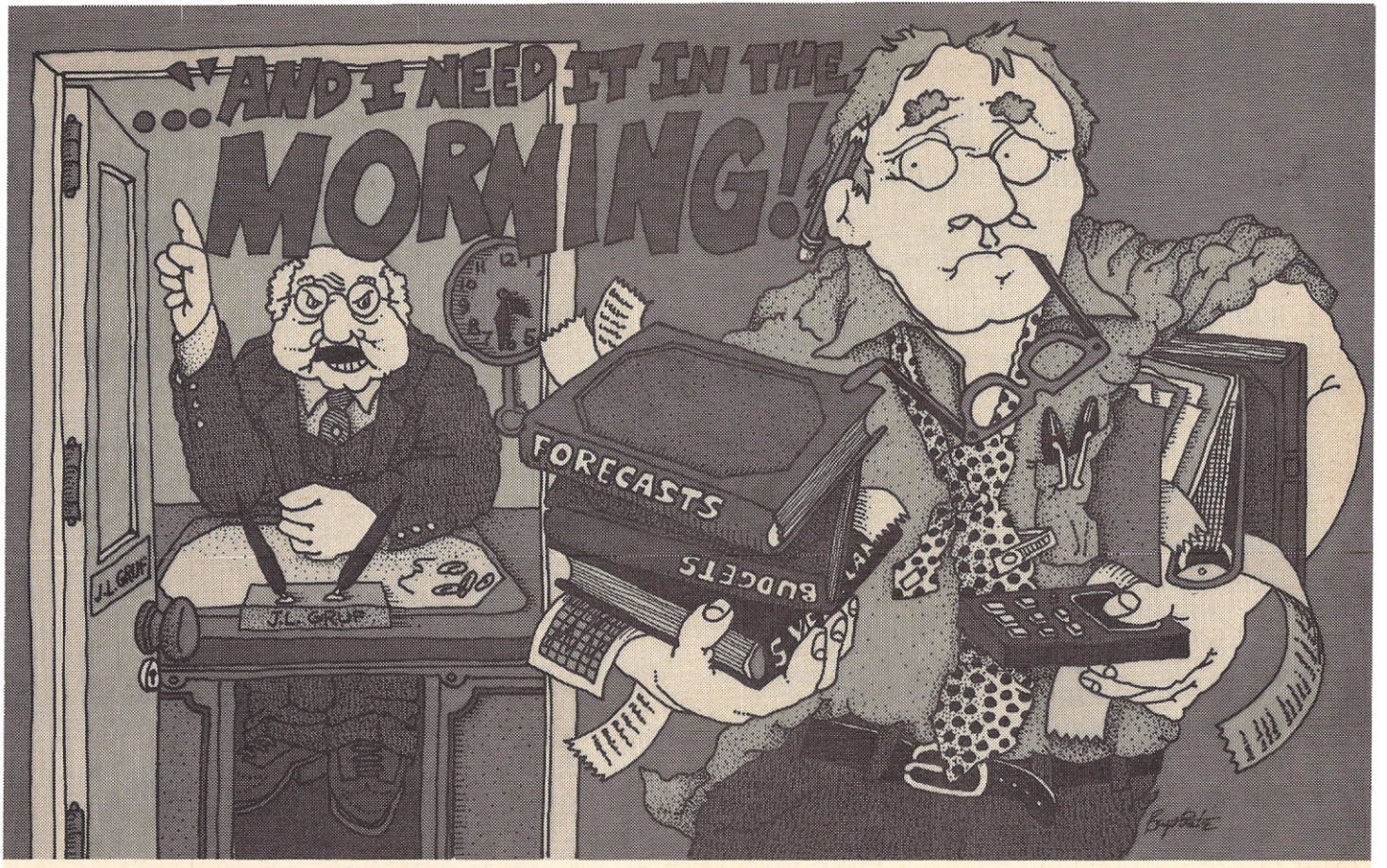

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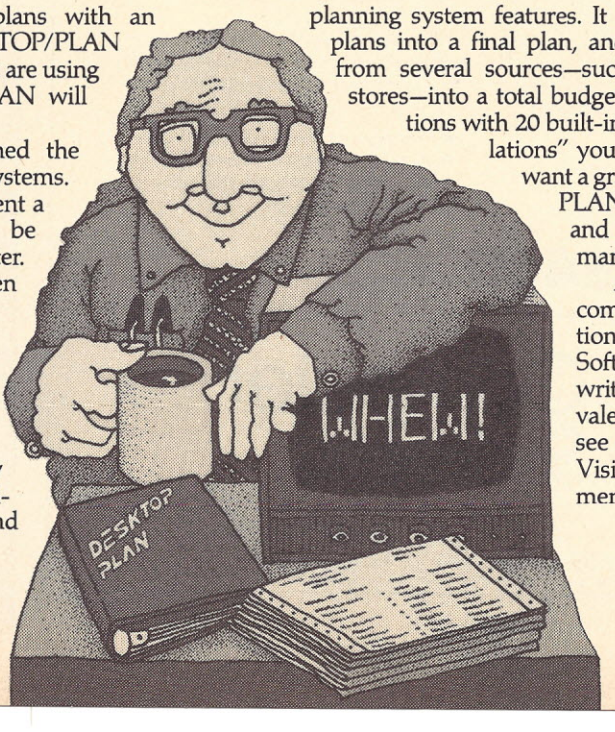

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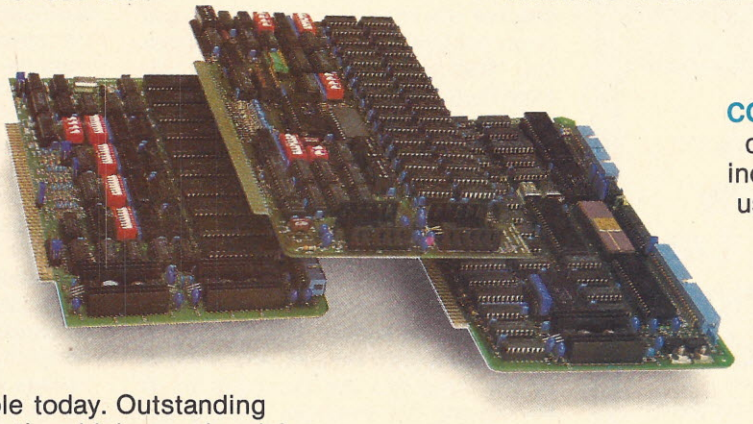

Z80 PROCESSOR BOARD — The most powerful CPU board available today. Outstanding features include 4MHz operation, high-speed serial and parallel I/O utilizing DMA or programmed control, eight vectored priority interrupts, and a real time clock.

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EDITOR'S NOTEBOOK

Some thoughts on buying a computer

In all activities where one person is selling something to another, there are those sellers who operate best when the buyer is essentially ignorant of the product or service being bought. In some cases, suffice to say, the sale would never have been made if the buyer had the slightest knowledge of what he or she was buying. Snake oil salesmen and con artists are with us even today.

Is this condition true in the computer industry? Are there sales types who are deliberately defrauding the purchasing public—and getting away with it because the victims are too uninformed to recognize that they are being taken to the cleaners? We haven't spotted much evidence of widespread abuse of computer purchaser trust for some time. And as carriers of advertising to the computer industry, we watch closely.

But part of the problem still exists, although in a far less sinister form. Computers, after all, are so new that the world is generally ignorant of their inner workings. Unless you are very young, chances are the word "computer" was never mentioned in your formal schooling. What you know about them, you most likely learned on your own. Couple this endemic lack of knowledge with the fact that computers have the potential of becoming the most powerful business tools ever invented, and you have a situation ripe for abuse.

Computers and knowledgeable computer people are in desperate demand. The need—particularly for programmers—far exceeds supply. The industry is acting like a giant vacuum, and workers by the thousands are rushing in to fill the waiting job positions. Here's the *caveat emptor* however: not all of these "professionals" are of top quality.

These days, a computer professional doesn't have to be very good at his trade to make a comfortable living. Why? For two reasons: the demand for computer people—designers, sales people and programmers—has never been higher, and many who purchase the services of these people aren't equipped to weed out the good from the bad. Most of us can spot a good typist. You only have to watch one at work and inspect the final product. If you see just two fingers flashing, that's bad. If words are misspelled, that's bad, too.

But how many of us know a good computer program—or computer—when we see one? How long is it supposed to take to write a customized invoicing program? Few of us know, but we will... in another generation, when computers are as routine as automobiles and refrigerators. We (or our grandchildren) will eventually become informed, steely-eyed, hard-to-fool computer purchasers.

Until then, our only defense is knowledge, self acquired. And, just like all newly-learned skills, this knowledge will come hard. It will take a lot of valuable time to do the job right. Night courses at the local community college are a good idea. If you belong to a business group or service club, make sure you don't miss the meetings featuring guest speakers from the computer industry. Visit the computer stores, all of them within your reach. (Ask lots of questions, and don't worry about sounding "dumb." After all, how much do those salesmen know about *your* area of expertise?)

Make a recreation out of learning about computers. Home-size units are getting pretty expensive these days, so take one into your home. Buy some games for it to get the "feel" of computing. Above all, try your hand at programming. Do this even if you have no intention of ever writing a serious business program. It's part of the computer education—perhaps the most important part. Who knows, you may even become addicted, as have thousands of others. Besides being a useful—even profitable—endeavor, programming a computer can be a relaxing, enjoyable experience sought out for its own sake.

Don't think such a course of self-education is unnecessary; it most emphatically is. Computers are becoming so capable they are sure to be absolute necessities in even the smallest of businesses within a very few years. If you aren't computerized by that time, you can bet your competition will be—and you will be spending most of your days playing catch-up in a very fast game.

Lest we sound too negative about the quality of help in the computer business, let us say that the problem is far from epidemic. This business has developed a large cadre of competent, hard-working people; many of whom we are fortunate enough to call our friends. The career rewards for such professionals are excellent. Outstanding people are responding to the call, and the selection is getting better all the time. Your goal should be to become knowledgeable enough to identify the best of these to help you get your computer up and running—or, perhaps, to become such a person yourself.

TF

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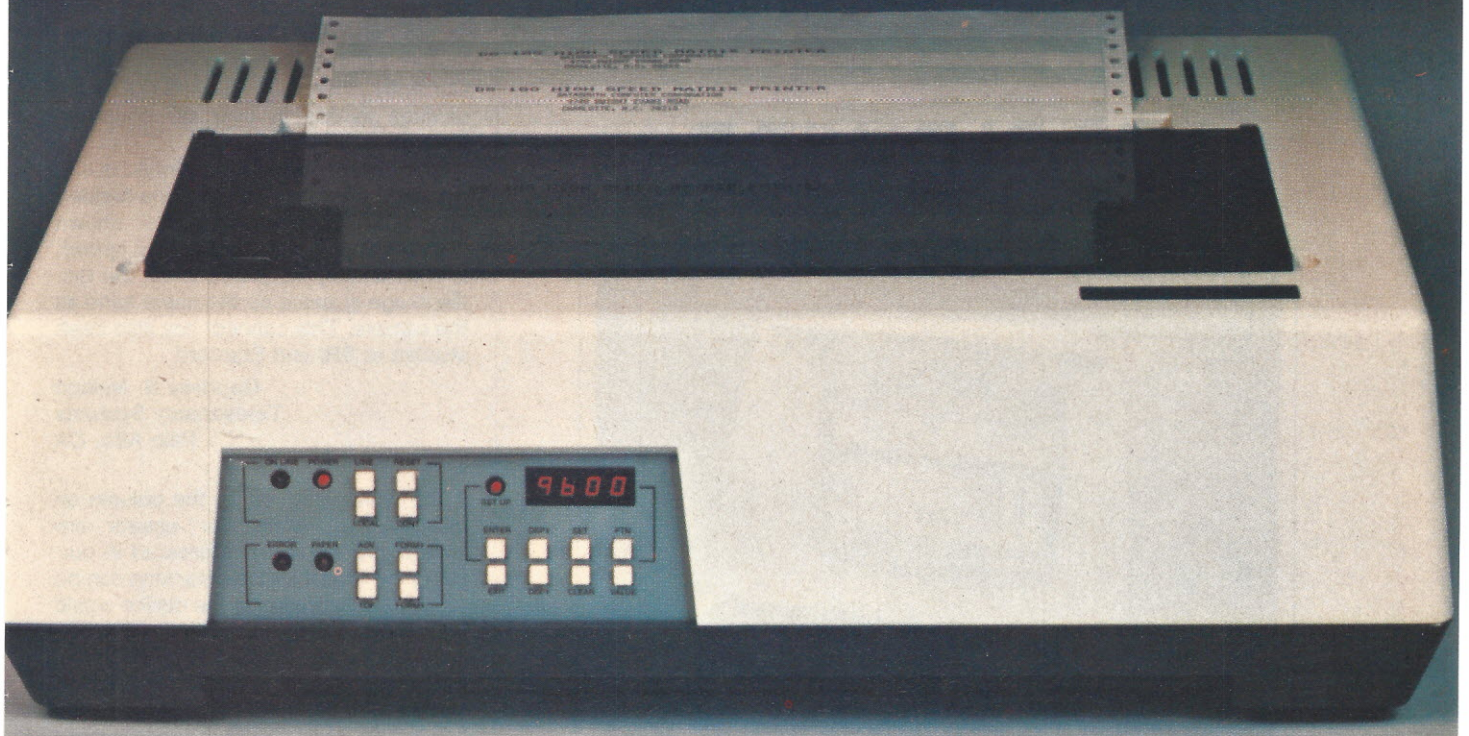
THE TOTAL PRINTER PACKAGE!



With so many matrix printers on the market today, it may seem tough to find exactly the right one for your application. Some models may offer the speed you need, others the communications flexibility and still others the forms handling capability. But no printer offers **all** the features you need...until now.

The DS180 matrix printer provides the total package of performance features and reliability required for applications such as CRT slave copy, remote terminal networks and small to mid-range systems. Not a "hobby-grade" printer, the DS180 is a real workhorse designed to handle your most demanding printer requirements. And pricing on the DS180 is hundreds of dollars below competitive units.

High Speed Printing—Bidirectional, logic-seeking printing at 180 cps offers throughput of over 200 lpm on average text. A 9-wire printhead life-tested at 650 million characters generates a 9x7 matrix with true lower case descenders and underlining.

Non-volatile Format Retention—a unique programming keypad featuring a non-volatile memory allows the user to configure the DS180 for virtually any application. Top of form, horizontal and vertical tabs, perforation skipover, communications parameters and many other features may be programmed and stored from the keypad.When your system is powered down, the format is retained in memory. The DS180 even remembers the line where you stopped printing. There is no need to reset the top of form, margins, baud rate, etc....it's all stored in the memory. If you need to reconfigure for another application, simply load a new format into the memory.

Communications Versatility—The DS180 offers three interfaces including RS232, current loop and 8-bit parallel. Baud rates from 110-9600 may be selected. A 1K buffer and X-on, X-off handshaking ensure optimum throughput.

Forms Handling Flexibility—Adjustable tractors accommodate forms from 3"-15". The adjustable head can print 6-part forms crisply and clearly making the DS180 ideal for printing multipart invoices and shipping documents. Forms can be fed from the front or the bottom.

If you would like more information on how the DS180's low-cost total printer package can fill your application, give us a call at Datasouth. The DS180 is available for 30-day delivery from our sales/service distributors throughout the U.S.

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LETTERS

Program notes

Re: "TRS-80 Program Recovery" (IA Dec 80), there is, indeed, a solution to the problem of inadvertently shutting down equipment. Merely wire a second switch in parallel with the original one. The resultant "gate" will remain on unless both switches are turned off. (A jack and shorted plug would serve as well as a switch.) Install the new part in any inconvenient locus. I have used this arrangement to protect the filaments and power supply components of my ham gear.

Les Davies
Middle Village, NY

Brain picking

I recently purchased a Video Brain microcomputer with as much software as I could find. Now I am anxious to expand my system, but cannot locate any compatible peripherals. I especially need an expander interface. Can anyone help?

Rory Allen Griffith
102-F Forest Gardens
Moose Jaw, Saskatchewan
Canada 56J 1E6

Touch concept reaches out

I noted with interest the Inventor's Sketchpad on touch-vision (IA Dec 80).

The device mentioned is known as the optacon, an acronym for optical to tactile converter. This device is manufactured and marketed by our company. Currently, there are nearly 8,000 such devices in use in over 60 countries throughout the world.

The pistol approach mentioned is one we know internally as the "one-handed optacon". Experiments have shown that tracking, and hence reading speed, is substantially increased when the tactile image appears on the same hand as the camera. This concept has also been studied at SRI and Stanford.

Geoffrey B. Nelson
Telesensory Systems
Palo Alto, CA

We were intrigued by the column on touch-vision. While our assets are limited, we would be interested in pursuing the idea if suitable backing can be found. Our approach to the device would be somewhat different from the one outlined. We would prefer to use thick-film hybrid techniques to put the phototransistors directly under the finger, and use hybrid thermal-printer heads instead of vibrating elements.

Al Anway
Poly Micro Systems
Roanoke, VA

Equal time for ISAM

Your article on the IBM 5120 (IA Jan 81) pointed out all the faults of the system, but failed to point out its chief asset—a remarkable ISAM in the disk system that more than compensates for its slow operating time.

Keith P. Graham
West Nyack, NY

Additional recovery

Re: "TRS-80 Program Recovery" (IA Dec 80). There is a procedure already present in ROM that effectively carries out the same process:

```
POKE 17130, 1 (or any other value <255)
SYSTEM <ENTER>
*? / 11395 <ENTER>
```

Paul B.H. Horbury
W. Yorkshire, England

The Perfect Fit

The Micromodem II data communications system and the Apple II* computer. What better combination to maximize the capabilities of your personal computer!

This popular direct connect modem can transmit data between an Apple II and another Apple II, a terminal, another microcomputer, minicomputer or even a large time-sharing computer anywhere in North America. The Micromodem II has unique automatic dialing and answer capabilities which further increases the communications possibilities between the Apple II and another computer or terminal.

You can send and/or receive messages or data when you are out of your office, home or out of town. Your branch business locations can communicate with each other regarding inventory and other matters over the phone. Or you can communicate with friends across the country. And you can access information utilities like the SOURCE for various business and personal applications.

The Micromodem II consists of two parts. One part includes the printed circuit board which holds the Micromodem II, ROM firmware and the serial interface. The board plugs directly into the Apple II providing all the functions of a serial interface card plus programmable auto dialing and auto answer capabilities. The on-board ROM firmware enables the Micromodem II to operate in any of three modes to perform different tasks-terminal mode, remote console and program control mode.

The other part of the Micromodem II datacomm system is a Microcoupler which connects the Micromodem board and Apple II to a telephone line. The Microcoupler gets a dial tone, dials numbers, answers the phone and hangs up when a transmission is over. There are none of the losses or distortions associated with acoustic couplers. The Microcoupler is compatible with any North American standard telephone lines and is FCC-approved for direct connection in the U.S. It works with standard dial phone service or Touch-tone service.

The Micromodem II is completely compatible with Bell 103-type modems. Full and half-duplex operating modes are available as well as speed selectable transmission rates of 110 and 300 bps.

Why not increase your Apple II's capabilities by outfitting it with the sophisticated Micromodem II data communications system? The Micromodem II is available at retail computer stores nationwide. For the store nearest you, call or write:

CIRCLE INQUIRY NO. 38

Hayes™

Hayes Microcomputer Products Inc.
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The Micromodem II can also be used with the Bell & Howell computer.

LETTERS

Pros and cons

The article on our system 110 (IA Dec 80) was well done. We admire the candor and objectivity that Tom Fox put into this piece, and his research. He didn't hesitate to spell out the system's weaknesses—and all low-cost systems have them. At the same time, he gave us credit for the design and software advances we've worked very hard to achieve.

Chuck Ritley,
Director of Marketing Services
Qantel Corp.
Hayward, CA

Reader interface

I am interested in contacting computerists who are doing advanced forecasting on both stock and community markets.

Ted Brodir
Box 407
Flushing, NY 11363

Our school has acquired two Commodore Pet 16K microcomputers for its Industrial Arts department. We hope to use these computers to provide exposure for 7th grade students in a high-technology area. I would appreciate any information that may be useful in our development of a short computer awareness program.

Frank Ettenhofer
Franklin High School
Oak Street
Franklin, MA 02038

I would like some help in finding a terminal with an 80 by 24 format and a 7 by 9 dot matrix that is also capable of full graphics. Or, is there a good substitute with 7 by 9 and full graphics? It will be running off a Z-8001 with 128K memory.

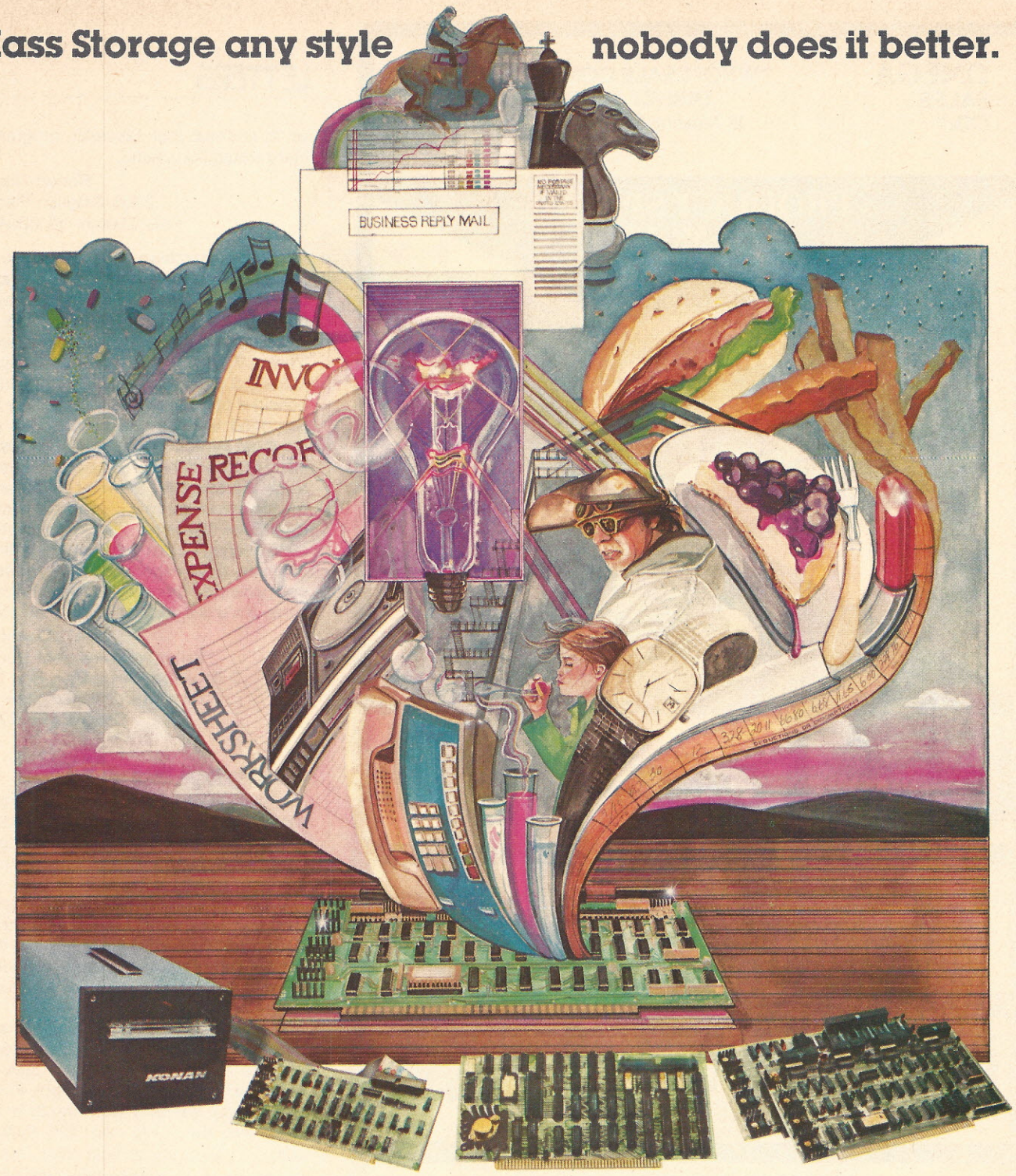
SP/5 Dennis Smith
A-Btry 3/7 ADA
APO NY NY 09702

Processor Technology Corp., now out of business, manufactured the Sol Computer and Helisos II disk driver. Where can we buy spare parts?

Marcus Pompeu
P.O. Box 2618
Lagos, Nigeria

I am preparing a handbook for assembly language programmers, consisting primarily of quick reference charts and tables, and universal programming tricks. I would appreciate suggestions

Mass Storage any style nobody does it better.



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LETTERS

as to material that assembly programmers would find useful.

Robert Rose
2205 Grayson Place
Falls Church, VA 22043

We are searching for good, reasonably priced business/data base software to run on a 64K Superbrain QD (two double sided, double density 5.25-in diskettes, total of approx. 700K), Centronics 737, CP/M 2.2. We also have MBasic 5.2 and Magic Wand but would consider other software if necessary to run good business packages. Two of the most attractive, because of the flexibility of their data base approach, seem to be the Micro-Ap Selector III C-2 and IV, and the various packages from Micro Data Base Systems. We would appreciate hearing from anyone who is willing to share their experiences with these companies. If there are better alternatives, we'd like to hear about that, too.

R.T. Quenett
Valterrus Investment Corp.
7 Broadway Ave., P.O. Box 70
Strongfield, Saskatchewan
Canada S0H 3Z0

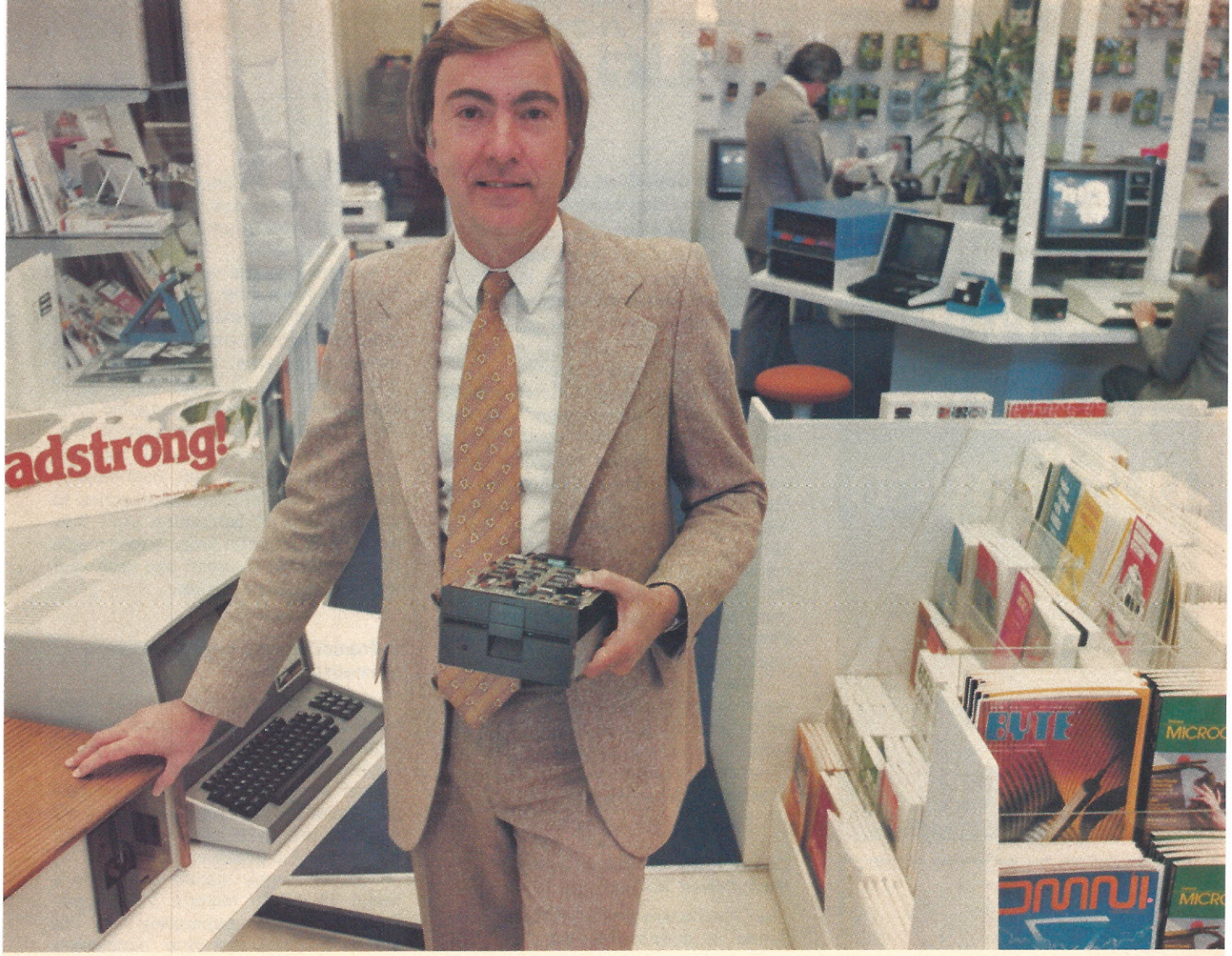
Program insurance

I have read with interest the arguments for and against protecting commercial software by making it uncopyable. As a software user in a remote location, I want to be able to back up any software I purchase so that if anything happens to it, I am able to continue with whatever I am doing. On the other hand, I would not write software for sale if I could not be certain that I would be paid for it.

Many distributors offer replacement copies of damaged software for a nominal fee if the original disk or tape is returned. This is a good idea, but, in my experience, warranty work tends to be slow and the mails can add further delay. I have been told that many producers of expensive business software offer back-up copies of the master disks for a nominal fee plus media costs either to registered purchasers or when requested at the time of the original purchase.

I think that the last option is the best answer to a bad situation. I would be willing to pay a media plus duplication fee at the time I purchase a piece of software to have a spare copy of the master of any working software and some games. I hope that producers and distributors will consider making duplicate masters available to small users as an option at purchase time.

Gerald Perkins
APO San Francisco, CA



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UPDATE

Hardware suppliers urged to resist builder competition

Suppliers of computing power to OEM system builders and integrators may be doing the industry serious damage if they do not pursue a disciplined partnership relationship with their customers, according to Allen H. Michels, president of Convergent Technologies.

"A manifestation of that commitment ought to be non-competition," Michels said. "There is a patent absurdity in a manufacturer offering the same technology both to his customer and his customer's customer. And yet, increasingly, we witness manufacturers being lured by perceptions of a lush systems market to do exactly that. It is unfair to the OEM systems designers upon whom many of these manufacturers have built their companies, and I am convinced that in the long run, it is self-defeating."

"The economic pluralism that makes America tick applies just as effectively within industries," Michels said. "We prosper virtually in direct proportion to the manner in which we serve the people who buy what we have to sell."

Educational exchange group established in Germany

An Atari users group has been introduced in cooperation with the U.S. Defense Dept's. Dependents Schools Europe based in Southern Germany.

The group is seeking well structured and documented programs for instructional use. Listings can be processed off cassettes or disk copies of clean programs ready for distribution. Students with a special interest in Atari assembler are being sought out to form a special interest subdivision within the organization. Sponsor Sam Calvin can be reached at 06105-1922 or (2141)-6181; correspondence at DODDS-S, APO NY 09164.

Some businesses still processing data manually

Computer use among small businesses is not yet as widespread as some industry spokesmen would like to believe.

A detailed study by Time magazine of all U.S. businesses with fewer than 500 employees reveals that some 82% are not utilizing computers in their operations and only 7% utilize an on-premise system.

Because the majority of U.S. companies are small, the report has a special relevance for the industry. Some 3.5 million companies employ less than 500 people; 3.2 million companies have less than 26 employees, representing a huge and virtually untapped market for small computers.

According to the report, regional differences have little effect on present methods of processing data. Projections of computer penetration from the sampled universe to all U.S. small businesses reflect a density of small businesses in various geographic locations. These projections indicate that, to tap this lucrative small business market, computer vendors must develop new and more efficient approaches to both sales and distribution. And they will have to consider broad-based media in their efforts to reach this vast—but widely distributed market.

Independent packaged software in record demand

The demand for independent packaged software is keeping pace with the fast-moving computer industry. A report by International Data Corp. projects an annual increase of 29% in software sales over the next four years. This will escalate the 1979 sales total of $920 million to $3.5 billion by 1984.

This enormous market growth is a result of IBM's historic 1969 decision to charge separately for its software. Since that time, consumers have increasingly considered alternatives to software developed by the hardware manufacturers.

According to Cary Morrill, who conducted the IDC study, independent software is on the rise due to lack of quality software from manufacturers and the increasing costs of in-house software development.

Of the various market segments—systems, applications, and utility software—the applications area continues to show the greatest growth, accounting for 50% of the total 1979 market. Applications software offers specific solutions to problems unique to any one industry, such as insurance or banking. By 1984 this will account for 55% of the total market, some $1.8 billion.

Computer industry experiencing 15% annual growth

Although both inflation and recession have had significant impact on other parts of the economy, the U.S. computer industry will continue relatively unscathed. From 27.9 billion in 1978, industry shipments will grow at an annualized rate of 15.3% to reach $49.2 billion in 1982. According to a market

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analysis by Venture Development Corp., the three key industry categories—computers, peripherals, and data storage systems—will all share a growth of about 15% annually.

The value of actual computer shipments will grow by 15.6% annually making it the fastest growing of the three industry groups. Within the group, smaller computers, though accounting for only a small part of total shipments, will show the greatest relative growth. Minicomputers, for example, will show a 26.7% annual increase in shipment value through 1982. Desktop computers will show a 36.5% dollar growth rate. Most impressive of all, small business computers will show a 39.1% annual growth rate. Much of this growth can be attributed to the growing popularity of specialized computers which help users to decentralize a wide range of computer functions.

Electronic interlibrary exchange opened with biolab

An ultra-high-speed facsimile link for transmission and reception of marine biomedical documents has been instituted to connect two University of Florida facilities and the Marine Biological Laboratory in Woods Hole, MA.

The facsimile system spans more than 1,200 miles to provide immediate interlibrary exchange services. Believed to be the first of its type, the long-distance system consists of high-speed digital facsimile transceivers that can send and receive printed or handwritten documents over ordinary telephone lines in 35 seconds.

In Florida, the C.V. Whitney Laboratory is linked with the 170,000 volume health center library at the University of Florida main campus in Gainsville 75 miles away. The Whitney Lab is a basic research facility specializing in cell biology, including tumor research, using marine organisms. The facility is small and relatively isolated.

A special feature of facsimile document delivery is that foreign language material can be transmitted directly without re-typing or translating. At Woods Hole, journals in the oceanographic, biological and biomedical sciences are received in more than 39 languages from research stations and publishing organizations around the world.

The high-speed facsimile system is also significant in providing rapid communications between a central library and remote facilities of many kinds. The MBL library currently receives 6,000 requests for data or publications a year.

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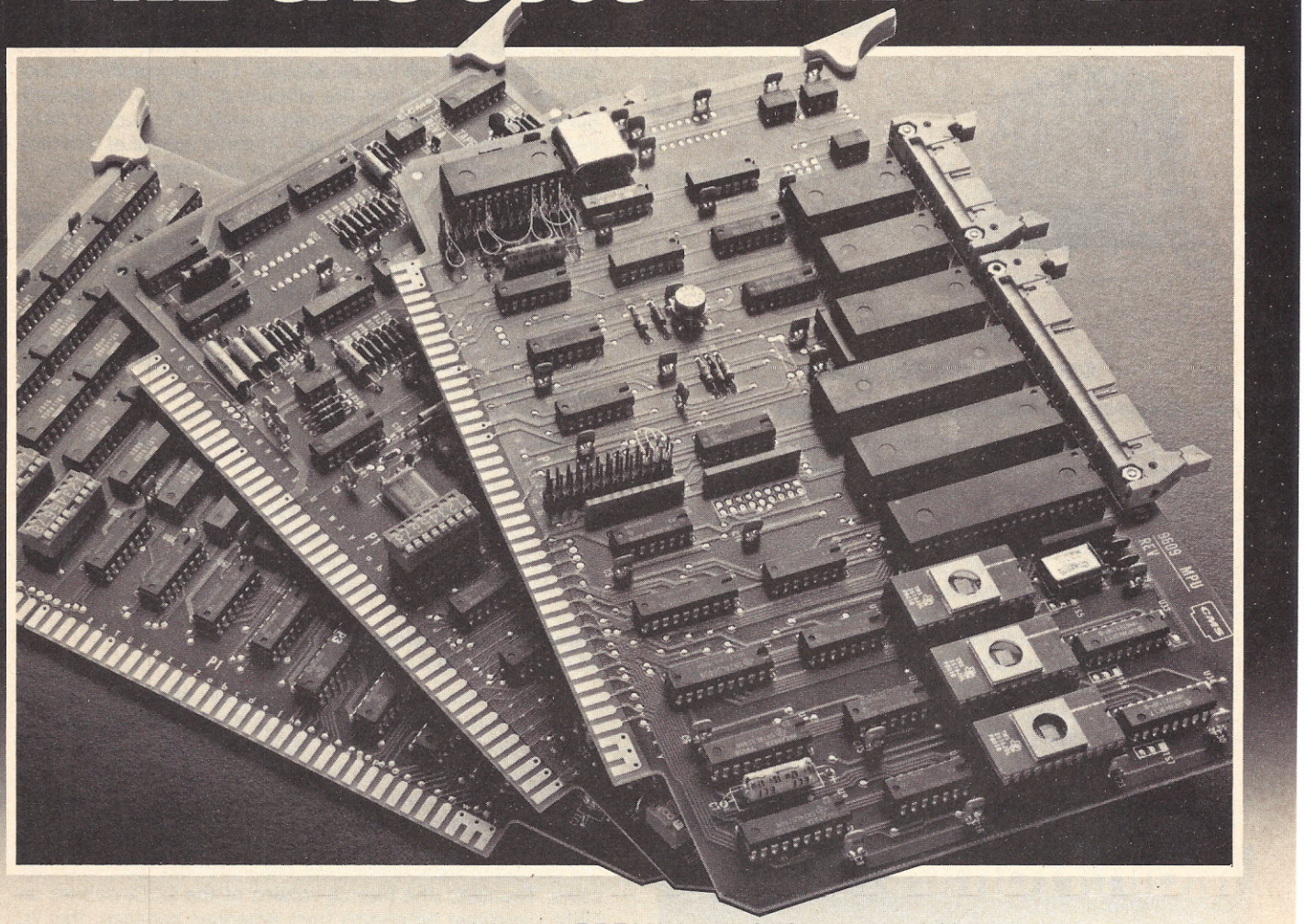

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Find us in the 1980 IC Master Catalog on pages 2608-2609.

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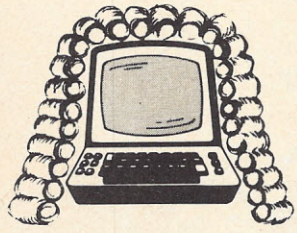

By Elliott MacLennan
Attorney at Law

OEM Legal and Tax Update

New Research and Development Tax Credit

Under present law a person or firm engaging in R&D operations may elect to deduct from income taxes qualifying R&D expenditures all in one year (the current deduction) or, over 60 months or more. A taxpayer may use different methods of financial and tax accounting for R&D purposes. The two accountings must, however, be capable of reconciliation. Many taxpayers charge testing and quality control to their R&D account. This is in error, says the IRS. Rightly, they are not R&D expenses but rather "ordinary and necessary" business expenses and are currently deductible. A taxpayer should always take the current R&D deduction as opposed to spreading it out over a longer period where company profitability is not presently ascertainable.

The new 25% credit applicable to R&D expenses began January 1, 1981. This credit for a corporation is in addition to the deductions already allowable. Almost universally, a tax credit is better to have than a deduction because a credit offsets your tax burden dollar for dollar against the actual taxes imposed against you. Where you receive a deduction and a tax credit for the same operation, the best of all possible worlds has been obtained. For an individual, the double credit-deduction will not be allowed. The permissible deduction will be reduced by the amount of the credit allowed. Some confusion exists in my mind owing to the lack of information available on the new law; it would appear at this time that corporations will definitely reap tax advantages over individuals affected by the new law.

Three further points are noteworthy about credit provisions. Firstly, corporations that have excess R&D credit over taxable income can carry back the credit 3 years or forward 7 years. Accordingly, new R&D expenses for some corporate taxpayers will cause them to receive a refund from the IRS!

The new credit is known as an incremental credit, meaning that the 25% credit will be allowed only to the extent R&D expenses exceed the base period R&D expenses. The base period is the prior year's R&D expenditures.

Lastly, rumor has it that the IRS will include rules to determine whether there has been a true increase in qualifying R&D expenses or merely a "creative" accounting shift. Advance planning for R&D expenditures is critical for obtaining the old deduction and new credit provisions. With the advent of the new credit, we should all be seeing an avalanche of R&D tax shelter set-ups. Why not? They work!

Valuation for Custom's Purposes of Computer to Foreign OEMs

The Customs Co-Operation Council composed of 80 countries has recently published a study spanning several years under the heady title " Dutiable Value of Computers and Program Media." The major change to be implemented is in the software area, which had formerly been valued for customs purposes at the value of the media. It is now set to be valued at its cost to the customer. For our purposes, of all the increased value shifting the one victim escaping in OEMs sales. The CCD (the French version of the CCC) defines an OEM somewhat differently from American parlance, that is, an OEM transaction is one between two manufacturers where one needs to supplement or build up its range of hardware. CCC and CCD are aware that substantial trade discounts are often granted to manufacturers who sell to independent OEMs. The study concludes that these prices will be accepted for customs valuation purposes to conform with established trade practices.

Computer firms engaged in exporting both hardware and software should scrutinize the valuation approaches applicable to the transaction in progress and allocate, bundle, or unbundle the particular products involved to minimize that customs valuations burden.

Why Isn't There a Standard Computer Contract?

Management policy evaluating the economic clout of its own firm as opposed to mainly legal considerations is the answer. Protecting proprietary data (method selection), inclusion or exclusion of maintenance charges, product liability concerns, warranties and disclaimers, not to mention a host of technical options available for distribution are other factors.

A lawyer specializing in computer contract drafting views the specific contract clauses much the same way a computer salesman or customer regards the optional features provided by a given system: the purchase of say, additional but presently unneeded memory may be a prudent investment where the supply availability is unpredictable. Computer contract clauses are usually more sensitive than are contract provisions for other less technology oriented industries because a specific clause may bear a direct relationship to bottom line

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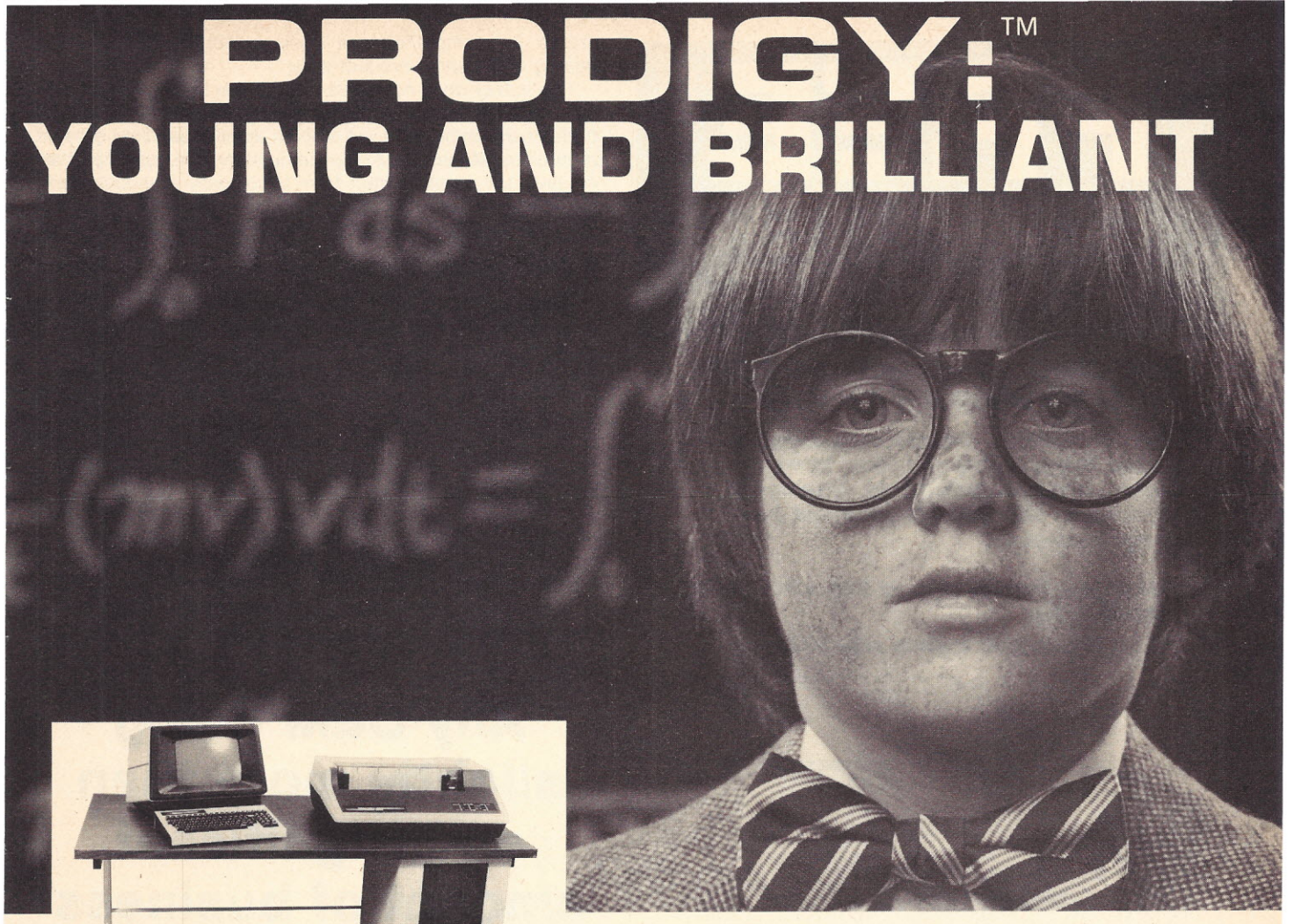

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profits and competitiveness among other computer kinfolk dealing in the same product area.

This author does not stand alone in the legal community in strongly believing that fairness to a customer or fellow tradesman can be achieved without an alter sacrifice of legal protection. Moreover, it is an unquestionable assertion that creative tax planning both from a company standpoint and contracting drafting standpoint can materially enhance profitability and mitigate or reduce competitors marketing position.

Product Liability Losses

Wouldn't it be a perfect world if an OEM had ready cash for the purchase of a huge product liability insurance policy and a bulging cash war chest for advertising exposure? On several occasions, I have been faced with the dilemma of a computer firm having funds for one and not the other. Where general liability exposure is not significant and the risk of personal injury nil, I recommend incorporation as a substitute for an insurance policy and expending the single fund for media visibility and customer attraction.

The 1978 Tax Reform Act took some of the sting out of an expense incurred in the investigation of, settlement, or opposition to a claim against a computer based on product liability. Product liability means responsibility for damages on account of physical injuries or emotional harm to individuals,

Any OEM doing slightly more than an insignificant amount of business abroad should make a serious inquiry into DISC benefits.

economic damage or loss of the product use brought about by a defect in a given product that is manufactured, leased or sold by the company only if the injury, harm, or damage occurs after the company has relinquished control of the product to the customer or placed it into the stream of commerce.

The Act provides for a 10 year carryback for certain product liability losses. In effect, a company suffering such a loss may be able to obtain a refund of all its expenses concerned with the loss from the IRS. On the positive side, a company finding itself in the enviable position of having accumulating profits can earmark a reasonable anticipated amount for products liability losses without running afoul of the accumulated earning tax surcharge (27½% or 37½%) in addition to all other federal income taxes.

DISC (Domestic International Sales Corp.) is an effective way of immediately deferring 50% of the federal income taxes on exported items. Categorically, any OEM doing slightly more than an insignificant amount of business abroad should make a serious inquiry into DISC benefits. DISCs are legitimate but paper dummy corporations whose benefits inure more to the small exporter than the large. A DISC combined with an FISC (Foreign Internation Sales Corp.) can defer more than 50% of the income tax payable. At today's interest rates, a tax deferred long enough is never paid economically. □

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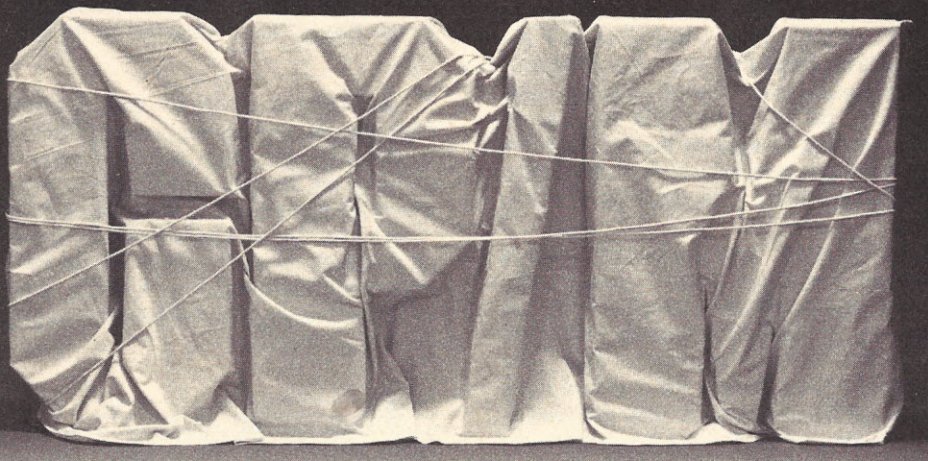

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Music Player

In the June 1980 issue of IA I presented a program that plays music on the Apple II. The Atari computer can also be made to play music, but the process is different. In fact, the greater musical power of Atari Basic makes it more difficult to play simple tunes. The program, Music Player, uses the same musical notation described for the Apple. The same tunes described then will play without change on the Atari and the new tunes presented here can also be used on the Apple. The difference is that songs played on the Atari are one octave higher.

Before describing the program, let's review the musical notation we will be using. The seven notes of the C major scale are represented by the numbers 1 through 7. On the Atari, the octave beginning at middle C is default. The figure below shows the three octaves provided on the Atari. The bottom row written between the staves is the standard notation. This is an incomplete notation. To play a tune, you have to see the notation drawn on the staves. Without the picture, you don't know which octave to use. The top row of numbers is the pitch notation required on the Atari's 'sound' statement.

The 'sound' statement uses four numbers. The first number determines which of four separate voices are used. We will use voice zero. The second number is the tone's pitch as mentioned above. The third number is the loudness of the tone and the fourth number is the tone's quality. We are going to use a 10 for both of these numbers to represent a pure tone of moderate loudness. The 'sound' statement does not let you set the length of the tone. This is done by writing program delay loops.

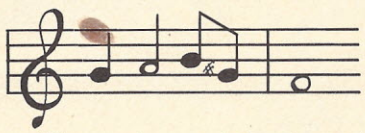
The middle row of numbers is the musical notation we will use (see figure). With additional symbols, this notation is complete. In fact, it can be used to control all four voices simultaneously. But for now, I will cover only enough of the notation to play simple tunes in one voice. Here is a summary of the rules for the basic notation:

- 1 through 7 are the notes of the C major scale.
- Use a * in front of a number to go up one octave.
- Use a / in front of a number to go down one octave.
- Use a – in front of a number for a flat note.
- Use a + in front of a number for a sharp.
- Use zeros after a number to extend a note.
- Use a blank for a rest.

I have provided several songs. Run the program and it will ask you to enter a portion of the song. Enter as much of it as you want and press 'return'. It will ask for more of the song. Continue entering the song in this way until you are finished. Press 'return' to play the song. You can play the same song as much as you want, or enter a new song.

Once you have finished playing the songs listed here, play your own. It is easy if you can read sheet music. If you can't, find someone to help you. To convert a piece to our notation, find the shortest note in the music. This is often a note with a single flag or line connected to its shaft like this  or this  This type of note is called an eighth. If an eighth note is the shortest, then quarter notes, which are twice as long, will be followed by a single zero; half notes, which are four times as long, will be followed by three zeros; and whole notes, which are eight times as long, will be followed by seven zeros.

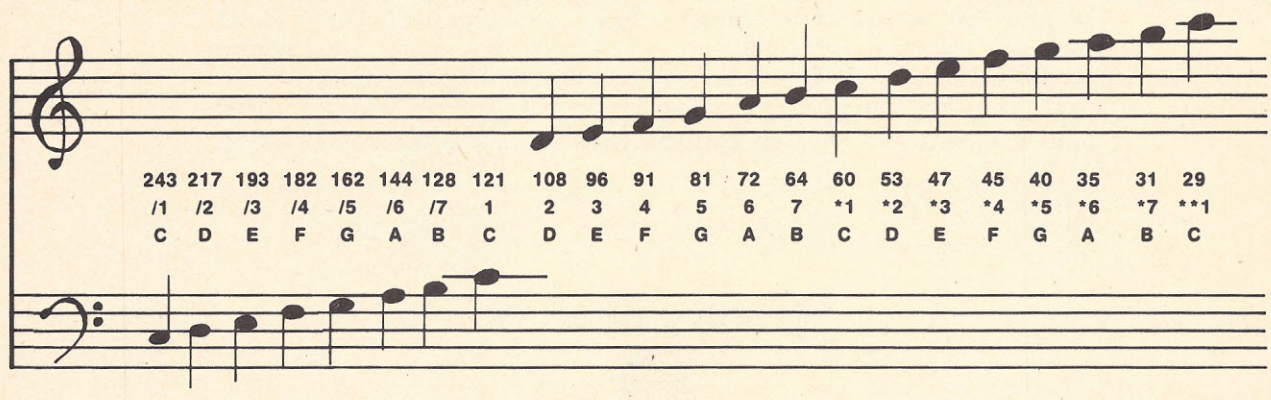
To make a rest where there is no music playing, place a single blank for each portion of the rest, which is an eighth note long. In other words, a whole note rest, which is eight eighth notes long, is represented by eight blanks. Here is a sample translation:



= 5060007 + 540000000

If the music sounds too slow or fast, change line 230 of the program: DUR = 30. Use a larger number to slow the music down or a smaller number to speed it up.

Lines 60 to 150 place the musical pitch numbers used by the Atari 'sound' verb in the 'key' array. 'Key(1)' is C an octave below middle C and 'key(37)' is C two octaves above middle C. Lines 170 to 210 are a little more complex. The seven entries in the 'scale' array contain the correct subscripts in the 'key' array for the seven notes in the C major scale beginning at middle C. For example, since 'scale(1) = 13', then 'key(13)' is the correct pitch number for middle C. Thus, 'sound 0,scale(key(1)),10,10' would play



The Musical Scale: First row of numbers is the note's pitch number on the Atari 'sound' statement. The second is our song notation.

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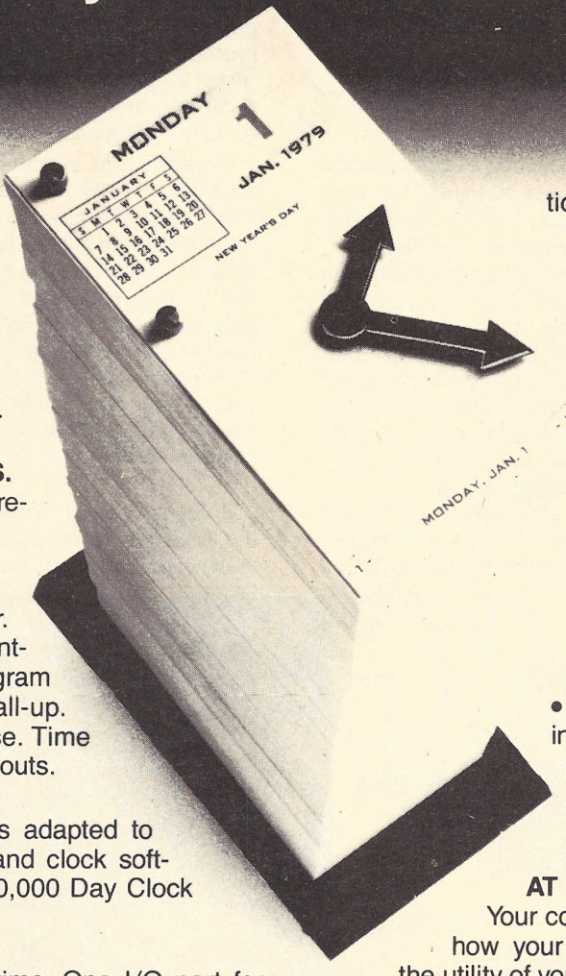

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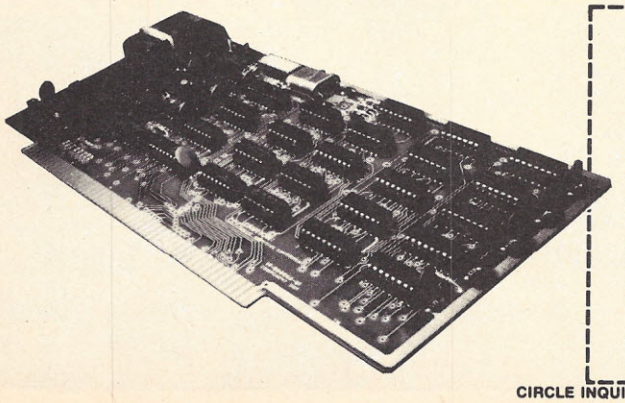

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middle C, 'sound 0,scale(key(2)),10,10' would play the next note, which is D, and so on.

The array 'song' will eventually contain the list of note pitches which make up the song to be played and the array 'slen' will contain the length of each of these notes in multiples of the number in the variable 'dur'. A$ is the string which receives the song portions as they are typed. These portions are connected together to form the complete song in 'song$'. Building the song string is done in lines 330 to 390. Notice that the variable 'I' is used to locate the next available character in the string 'song$'. This is how strings are connected together, or concatenated, in Atari Basic.

As each note is processed, it is assumed to be of the shortest possible length.

Lines 430 to 480 form the remainder of the main program loop. After the song is played, you are given the option of listening to it again, or changing songs.

The subroutine which constructs and plays the song starts at line 1000. The variable 'oct' is used to contain a change in octave and 'mod' will contain a change in pitch needed to reflect sharps or flats. The current character in the 'song$' string is pointed to by 'I' and the current entries in the 'song' and 'slen' arrays are pointed to by the variable 'J'.

As each note is processed, it is assumed to be of the shortest possible length, in the default octave, and neither sharp nor flat. If a "*" or "/" is found before the note is picked up, then lines 1060 and 1070 modify 'oct' to add or subtract 12 half-steps on the musical scale to the note. Twelve half-steps form a full octave jump. If a "+" or "–" is found, the next note is modified with plus or minus one half-step in lines 1080 and 1090. Adding a half-step to a note makes it sharp, while subtracting a half-step makes it flat.

If a zero is found after a note, then the duration of the previous note is increased by the minimum note length in line 1110. As many zeros as necessary can be used to create long notes. On line 1140 a pitch of 0 is used to define silence when a space is discovered in 'song$'.

Once a number between 1 and 7 is found, lines 1180 to 1260 convert the number plus any modifiers into the pitch to be played. On line 1180, K is set equal to a number from 1 to 7. Line 1190 converts this number into an index to the correct pitch for the note in the 'key' array. This index is then corrected for octave and flat or sharp on line 1200 and kept within legal limits on lines 1210 and 1220. Finally, the correct pitch from the 'key' array is placed in the 'song'. Lines 1240 to 1260 update 'oct', 'mod', and 'J' for the next note.

Once the tune is converted, lines 1310 to 1390 play it. For each note in the song array, the 'sound' statement on line 1340 plays the correct pitch and the 'sound' statement on line 1370 turns it off. The only exceptions are rests, or silent portions, which are specified by a pitch of zero. In this case, the 'sound' statement on line 1340 is bypassed to leave everything quiet. The loop on lines 1350 and 1360 forms the timer for the length of each note. A three is subtracted from the duration to account for the time it takes to process the two 'sound' statements and the 'if' statement. Timings show this to be the right number. The fact that it equals the number of extra statements is a coincidence. □

Author's request: I have received a request to convert Mining the Asteroids to the Apple II using Applesoft Basic. Before I convert the program, is there anyone who would like to make

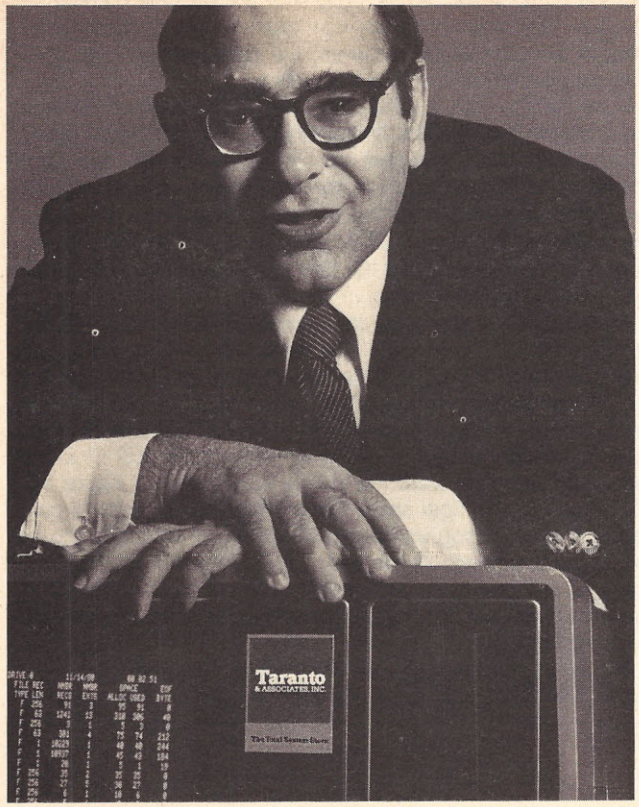
the conversion and send me the results? I'd love to present another conversion from a reader. This would require a major change in game design, but I'm sure there is someone out there who would like the challenge!

Listing 1

```
10 REM MUSIC PLAYER
20 REM
30 REM
40 REM INITIALIZE NOTES
50 REM
60 DIM KEY(37),H$(1)
70 FOR I=1 TO 37
80 READ N:KEY(I)=N
90 NEXT I
100 DATA 243,230,217,204,193,182
110 DATA 172,162,153,144,136,128
120 DATA 121,114,108,102,96,91
130 DATA 85,81,76,72,68,64,60,57
140 DATA 53,50,47,45,42,40,37,35
150 DATA 33,31,29
160 REM
170 DIM SCALE(7)
180 FOR I=1 TO 7
190 READ N:SCALE(I)=N
200 NEXT I
210 DATA 13,15,17,18,20,22,24
220 REM
230 DUR=30
240 REM
270 DIM SONG(300),SLEN(300)
280 REM
290 REM
300 REM CREATE THE SONG
310 REM
320 DIM SONG$(300),A$(100)
330 I=1
340 PRINT "ENTER SONG PORTION"
350 INPUT A$
360 IF A$="" THEN 430
370 SONG$(I)=A$
380 I=I+LEN(A$)
390 GOTO 350
400 REM
410 REM GO PLAY SONG
420 REM
430 GOSUB 1000
440 PRINT "PLAY IT AGAIN (Y,N)"
450 INPUT A$
460 IF A$="Y" THEN 430
470 IF A$="N" THEN 330
480 GOTO 440
960 REM
970 REM
980 REM CONVERT SONG
990 REM
1000 OCT=0
1010 MOD=0
1020 J=1
1030 FOR I=1 TO LEN(SONG$)
1040 SLEN(I)=DUR
1050 H$=SONG$(I,I)
1060 IF H$="/" THEN OCT=OCT-12
1070 IF H$="*" THEN OCT=OCT+12
1080 IF H$="+" THEN MOD=MOD+1
1090 IF H$="-" THEN MOD=MOD-1
1100 IF H$<>"0" THEN 1130
1110 SLEN(J-1)=SLEN(J-1)+DUR
1120 GOTO 1270
1130 IF H$<>" " THEN 1160
1140 SONG(J)=0
1150 GOTO 1240
1160 IF (ASC(H$)>ASC("0"))*(ASC(H$)<ASC("8")) THEN 1180
1170 GOTO 1270
1180 K=VAL(H$)
1190 K=SCALE(K)
1200 K=K+OCT+MOD
1210 IF K>37 THEN K=37
1220 IF K<1 THEN K=1
1230 SONG(J)=KEY(K)
1240 J=J+1
1250 MOD=0
1260 OCT=0
1270 NEXT I
1280 REM
1290 REM PLAY THE TUNE
1300 REM
1310 J=J-1
1320 FOR I=1 TO J
1330 IF SONG(I)=0 THEN 1350
1340 SOUND 0,SONG(I),10,10
1350 FOR K=1 TO SLEN(I)-3
1360 NEXT K
1370 SOUND 0,0,0,0
1380 NEXT I
1390 RETURN
```

Listing 2

```
Listing 2: Stars and Stripes Forever

5000504330+23              +*2*3*300000
300000+2330+23             +*2*3*30+*2*3
50354000200220             *4*3*27*2000
+1220+12400000             *10*10*107*1
3235006060200000           -*30*2*1*80000
*50*50*4*3*30              *1*2*3*5*1*2*3
                           *556*3*2000*1

Listing 3: Go Tell It On the Mountain

600065421000               *1060*10*100
400055055040               *2*1060004050
654021006000               504050600000
6542100040-70              *1060*10*100
66005450400000             *2*1060004050
                           504020100000000

Listing 4: The House of the Rising Son

602000324000               *200020440060
5+56000432000              666043200060
60*200060*1000             600060/6000
656000000000*20            4320000000

Listing 5: Shenandoah

/50111002346               5321000020
50000*1070                 30000136
600005653                  5000011230000
5000050666003              1210000

Listing 6: Michael, Row The Boat Ashore

10305003560                35605000030
500003050                  5060000000
600000005000               50003050500
30505003430                343020000
200001020                  1020300000
300000020                  201000
10001030500
```



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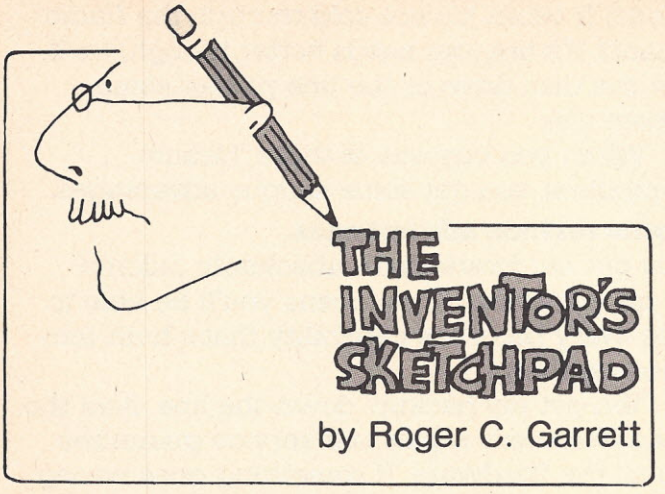

by Roger C. Garrett

More on Multi-Tasking Basic

Since the concept of multi-tasking is relatively new to programmers weaned on more straightforward programming, most of us are beginners when it comes to multi-tasking.

Look at the quite simple non-tasking program shown in figure 1a. It consists of statements numbered 10 to 270 with intermediate statements, which have no impact on the point I will be making, left out. Notice that we have a main program beginning at line 10 and a subroutine that extends from line 200 to 270. This subroutine is "called" from line 30 of the main program.

Figure 1b shows what happens as the program is executed, depicted as a series of arrows. We start at line 10 and "flow" through (and execute) lines 10,20,30 in sequence. At line 30 we encounter a 'gosub' statement that directs the flow to line 200 where it then proceeds through lines 210, 220, etc., eventually encountering 'return' at line 270. At this point the computer "recalls" where the subroutine was called from and directs the flow of control back to line 40, and so on.

What we actually have, then, is one long sequence of statements "connected" by the flow of control, and we could "stretch out" this flow into one straight sequence of statements (figure 1c). Indeed, this is how the computer sees the program, one statement after another, one statement at a time.

Now let's consider a multi-tasking program (figure 2a). We have a main program and several tasks and subroutines.

```
10  X=3*Y                    }
20  P=TZ-X                   }
30  GOSUB 200                } Main Program
40  IF X=9 THEN Y=ZR         }
50  INPUT X,N                }
  ≈ etc.                     } Rest of the main program
200 LN=RR+T*9                }
210 PRINT "RR"; RR           } Subroutine
  ≈ etc.                     }
270 RETURN                   }
```

Figure 1a. A simple non-tasking program

While in simple sequential programs we make a distinction between the main program and the various subroutines it calls; in a multi-tasking program, we consider the main program to consist also of all subroutines.

In figure 2b, we see what the flow of control looks like as the program is executed. It flows nicely through lines 70 and 80, but look what happens as we leave line 80; the flow breaks apart and goes off in three different directions; one part going sequentially to line 90, one part going to line 500, and another part to line 750. This does *not* indicate some form of branching, but that the flow of control goes in all three directions at the same time.

After line 80 is executed, the computer will execute line 90 and line 500 and line 750. The computer will be executing three separate tasks. The main task (task 0) continues on with line 90 and beyond; task number 1 continues on with line 500 and beyond; and task 2 proceeds from line 750 and beyond.

Let's stretch out this flow of control (figure 2c). It looks quite a bit different from the simple sequences of figure 1c. After line 80, the flow splits apart. This flow of control proceeds in time, which increases as we move from the top of the figure downward. If we draw a horizontal line through our figure at any point, we will intersect the flow of control and can determine what is being performed by the computer at that point in time.

Suppose, for example, we draw a line near the top of the figure. We might intersect statement number 70 and we could

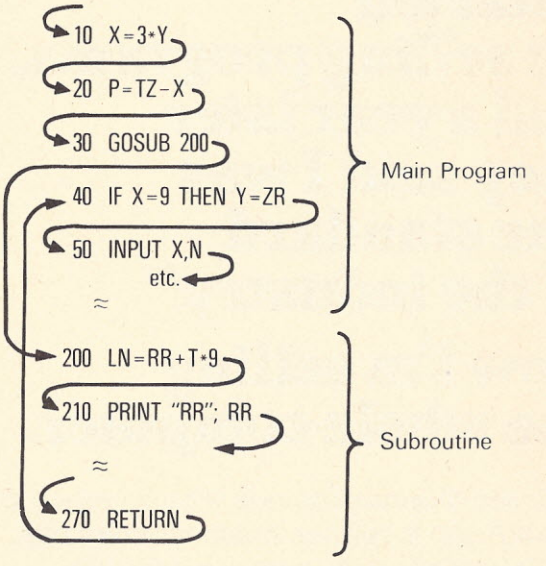

fig 1b

Figure 1b. The flow of control through a simple non-tasking program

see that the computer is performing the assignment statement QL = 97.3/F. But if we draw the line near the center of the figure, it might intersect statements 510, 100, and 760, indicating that all three are being processed by the computer at that point in time.

Notice something else which may at first seem peculiar; the flow of control that split after line 30 never comes back together. The thought of a programming structure that goes off by itself and never comes back again is certain to send shivers down the spine of any died-in-the-wool structured programmer. But consider: this is not a flowchart. We are not

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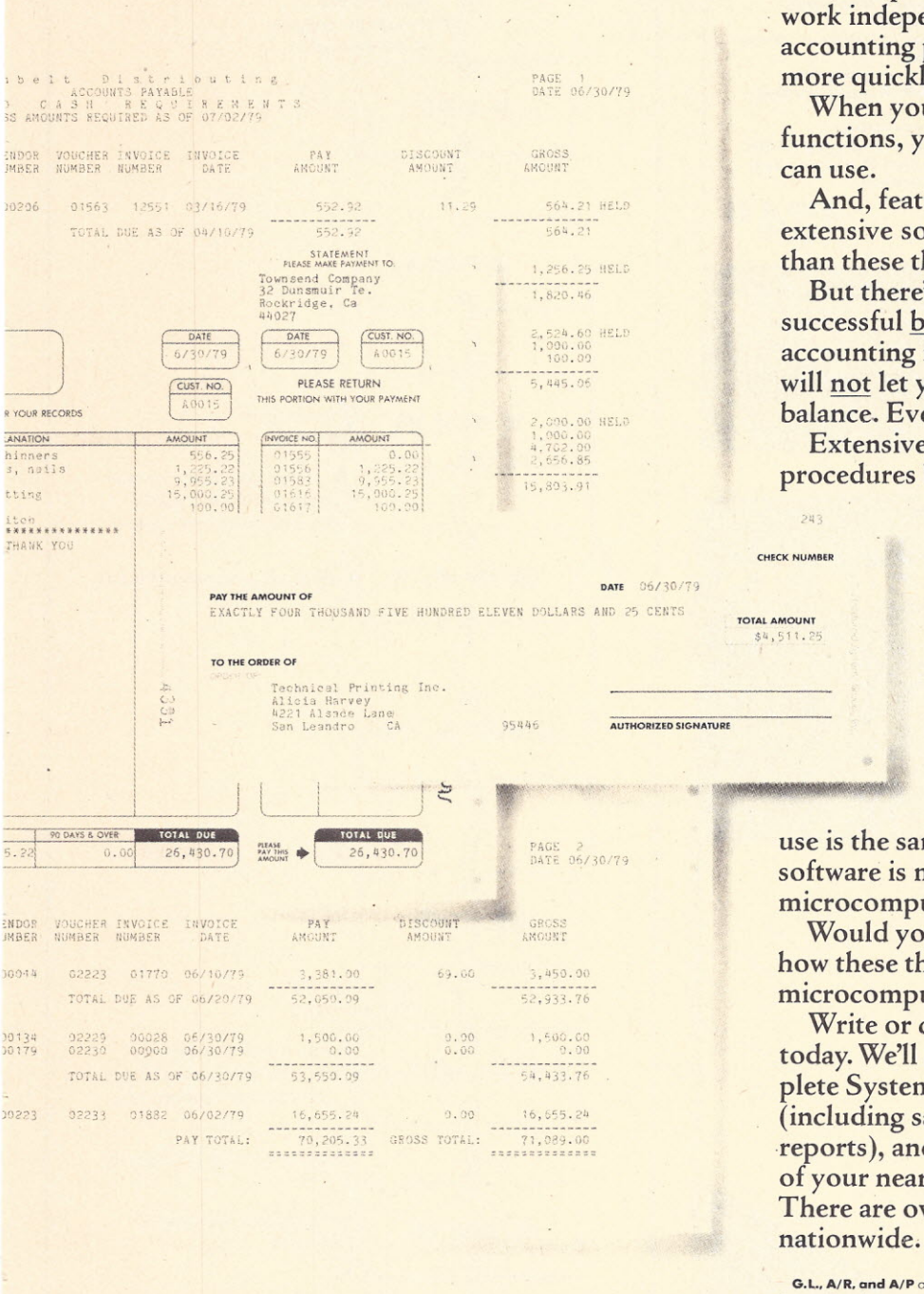

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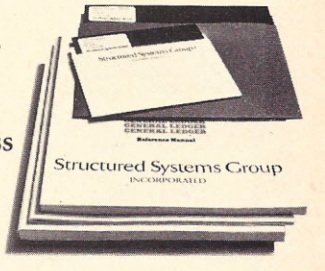

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invoking subroutines that must return to whence they came. We are, rather, setting up additional tasks for the computer to perform; tasks that run their merry way, possibly entirely independent of anything else that the computer is doing. When a task is finished, it simply stops. It has nowhere to logically return so the flow lines in the figure simply stop when the task is done. When all flow lines end, the program is finished.

Why, you might ask, would one want the computer to do more than one thing at a time? We don't *need* it, since we have been doing without it for some time. But suppose we want to write a program that simulates the flying of a plane. We need routines to keep track of our positions, to push buttons and move joysticks, to update dial displays and indicators, to keep track of fuel consumption, fire weapons, etc.

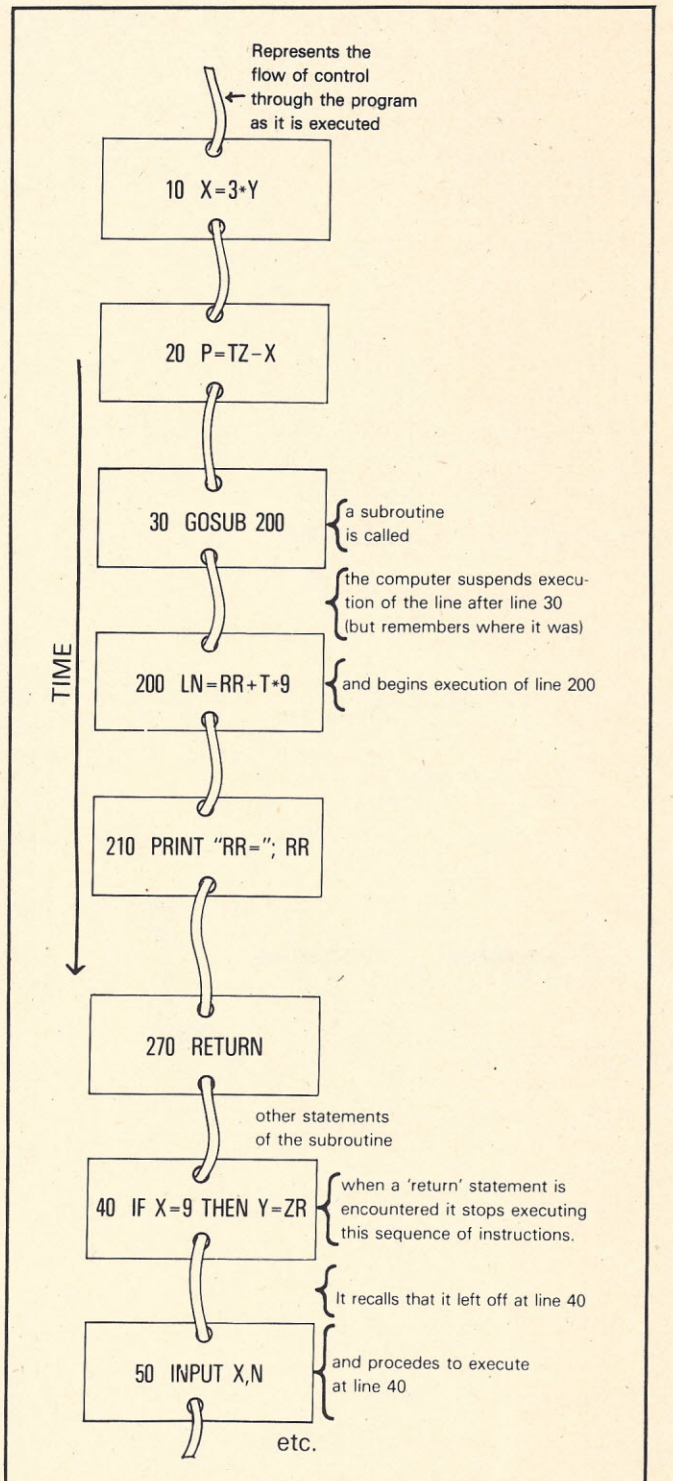

Figure 1c. The flow of control through a simple non-tasking program

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Each of these actions go on concurrently and independent of each other. Yet when we try to model them, we must process them sequentially: the dial display is updated and *then* the joystick is processed and *then* our position is updated.

We may, due to so many years of writing sequential programs, begin to think that it's the best or the only way to write.

We will provide the multi-tasking capability by adding a set of new statements and functions to Basic. I introduced the 'initiate' statement as the means by which a task is started. It now seems more reasonable to use 'activate' since that more closely implies that something else is allowed to proceed on its own; 'initiate' implies that it only *starts* or that variables are merely initialized.

```
ACTIVATE task__specification {,task__specification}
```

where each task__specification has the form:

```
line__number [AS__TASK task__number] [PASSING value__list]
```

The braces indicate that the section may be repeated zero or more times. Anything enclosed in brackets is optional, i.e., it may appear zero or one time. The words or phrases in capitals are keywords and must appear as is. Lower case indicates a programmer-supplied item (variable, expression, etc.). Any phrase or word not enclosed in brackets is required. For the 'activate' format, there must be one or more task__specification; each task__specification consists of a line__number optionally followed by an AS__TASK task__number section and optionally followed by a PASSING value__list section. Either the 'as__task' or 'passing' section may be left out but if they both appear, they must be in the specified order. The value__list in the 'passing' section has the form:

```
numeric__expression {,numeric__expression}
```

which means it consists of one or more numeric expressions.

The simplest form of 'activate' is one that only specifies a line number. This indicates that a separate task begins at the specified line in the program and it activates that task. For example:

```
80 ACTIVATE 500
```

would indicate that some task begins at line 500. When that statement at line 80 is executed, the task beginning at line 500 would start to execute. After line 80 is executed, two tasks are running: the one that line 80 is part of and the one that begins at line 500. So the next statements to be executed would be statements 90 (presuming that 90 followed 80) *and* 510 (presuming that 510 followed 500).

The second 'activate' specifies a task number, such as:

```
230 ACTIVATE 1200 AS__TASK 9
```

which activates the task beginning at line 1200 and gives it a task number of 9. This allows us, later on in the program, to reference the task by number.

Another form of 'activate' is given by the example:

```
105 ACTIVATE 300 AS__TASK 2 PASSING V1,97,RT%
```

which indicates that the task to be activated begins at line 300, is to be referred to as task number 2, and is to have three values passed to it.

What, you ask, do we mean by passing values to a task? If you are familiar with languages like Fortran, which allow parameters to be passed to a subroutine, you can understand the concept as one in which parameters may be passed *to* the task but not back *from* a task.

If, on the other hand, your only exposure is with Basic, you are probably confused. A simple example is a subroutine that uses the values in the variables X and Y to plot a point on the display screen of your terminal. We might set up the values and call the subroutine as follows:

```
50 LET X = 3 * B7
60 LET Y = 4 + COS(73.9)
70 GOSUB 500
```

However, we might run into problems if the subroutine at line 500 were to modify the values of X and Y but the state-

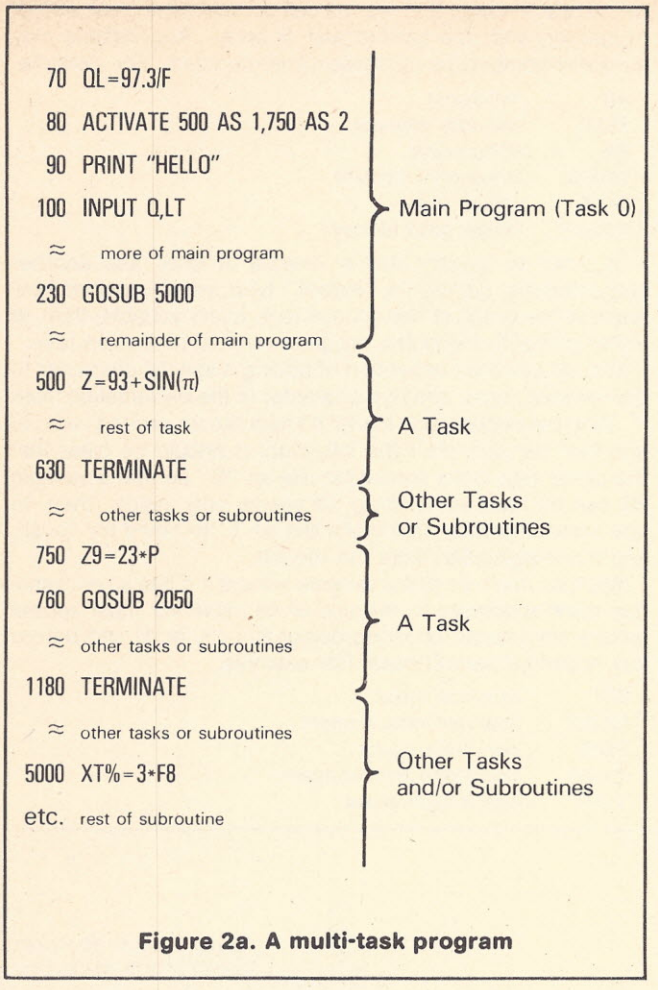

Figure 2a. A multi-task program

ments following line 70 expect to use the original values of X and Y. Furthermore, if the plotting procedure starting at line 500 were a task which we activated at line 70 (instead of a subroutine call), the rest of the program after line 70 might be modifying or referencing the values of X and Y *at the same time* that the activated task was modifying them.

There are several ways around this problem but one of the most elegant is by explicit passing of values, that is, by using the 'passing' portion of the task activation statement. Instead of the three statements given above (and assuming we are activating a task instead of invoking a subroutine) we have:

```
50 LET X = 3 * B7
60 LET Y = 4 + COS(73.9)
70 ACTIVATE 500 AS_TASK 3 PASSING X,Y
```

Or, if we don't really require the values to be in X and Y within the main program, we could simply have:

```
50 ACTIVATE 500 AS_TASK 3 PASSING 3*B7,4+COS(73.9)
```

In either case the values would be passed to the task.

It should be obvious that the task itself must have some way of receiving those values. That capability is provided by the 'receive' statement:

```
RECEIVE_VALUES_INTO variable_name {,variable_name}
```

To understand how this works, let's perform 'activate' at line 50, above, and that we have the following as the first statement of the task:

```
500 RECEIVE_VALUES_INTO AX,AY
```

When the activate statement is executed, it evaluates 3*B7 and passes the resultant value into the variable AX; the value of 4+COS(73.9) is determined and passed into AY; finally, the task beginning at line 500 (the first statement of which has already been processed) is activated and the computer proceeds to execute the rest of the main task (following line 50) as well as the newly activated task (following line 500). This would use the variables AX and AY in its computations and the main task would be free to use X and Y or whatever other variables it needs and not have to worry about the new task modifying variables that it (the main task) is using.

I consider this feature of passing values so handy that I'll even extend it to the 'gosub' statement as follows:

```
GOSUB line_number [PASSING value_list]
```

(Of course, the first statement of the referenced subroutine must be a 'receive' statement.)

What we did when we passed values into AX and AY, which are variables used only within the task, was to effectively define *local* variables. In actual practice, every variable in a Basic program is global, meaning that it can be used by any part of the program, even within subroutines. The local-ness of variables AX and AY, however, really exists only in the programmer's mind; they could still be used in any other part of the program, including within other tasks. While there will be many cases where we will want to have access to the same variable from many different tasks, there will also be places where we want to ensure that a variable used in, say, task 3 *cannot* be used by task 7.

You may recall that there are three general types of variables in Basic: real variables, string variables, and integer variables. Real variables are indicated simply by their name and may have real values (in the arithmetic sense). String variables are indicated by a dollar sign at the end of their name (AQ$) and have "values" that are strings of alphabetic (and sometimes graphic) characters. Integer variables have a percent sign at the end of their name (D%) and can only have integer values.

Furthermore, variables may be either scalar (having a single value) or arrays (having a set of values). Variables, then, have

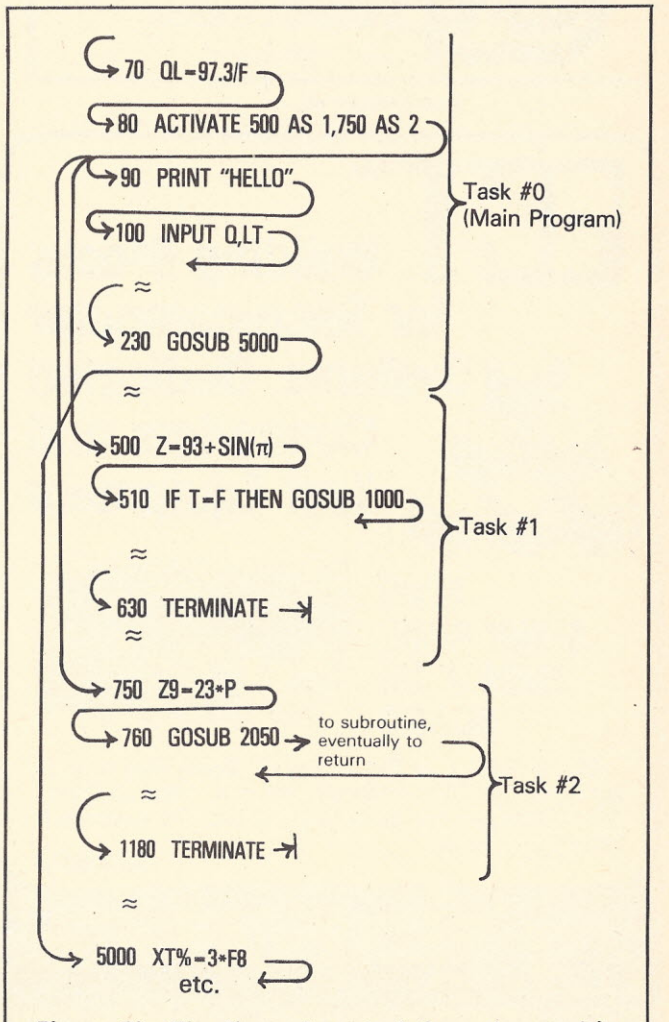

Figure 2b. The flow of control through a multi-task program

two characteristics that we will call content type (real, string, or integer) and size type (scalar or array). Any variable may have any combination of these characteristics. For example:

AB	real scalar
F(37)	real array element
D$	string scalar
DR$(9)	string array element
GQ%	integer scalar
P%(49)	integer array element

In order to specify that a variable is local, add another characteristic, namely its "extent" type, which signifies how much of the program has access to it. Every variable, then, is either *global* to the entire program or *local* to a given task.

We will use the convention of adding a special character to the variable name, and that character is the exclamation mark '!'. Why the exclamation mark? It looks like an excited variable and that certainly isn't the intention! It should be clear that the dollar sign looks somewhat like an "S" so that a variable B$ can be read as 'B-string'. It seems only logical, then, to use some character that looks like an 'L' to stand for 'local', and the exclamation mark fits the bill.

We have the rule that a variable is local if it has an exclamation mark appended to the end of its name but must appear before any integer or string designator (% or $) and before any subscript parentheses. For example:

DF!	local real scalar
Q!(32)	local real array element
PN!$	local string scalar
Z!$(2)	local string array element
TV!%	local integer scalar

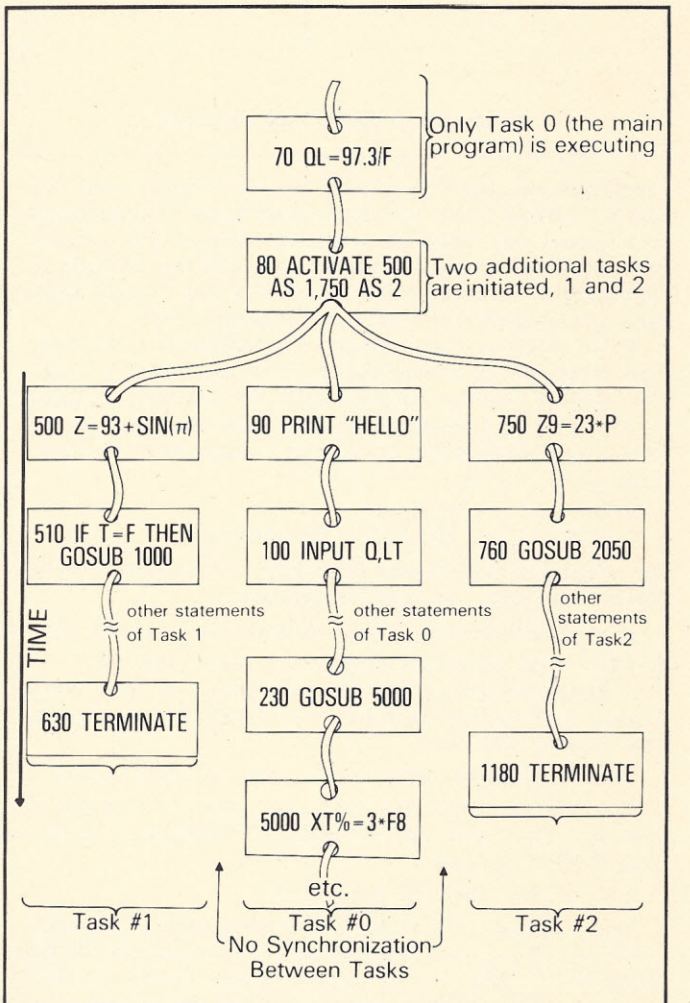

Figure 2c. The flow of control through a multi-task program

N!%(4,3)	local integer array element
E$!	invalid, "!" must appear before "$"
R(3)	invalid, "!" must appear before subscript

Whenever we use a local variable, we know that it is accessible only within the task in which it appears (remembering that the "main" program is always considered as task 0). If

```
Task Ø:
        ≈
    55  ACTIVATE 500 AS__TASK 2 PASSING X,Y
    60  AX=X+9
    70  BY=Y-3*B
    80  ACTIVATE 500 AS__TASK 3 PASSING AX,BY
        ≈

A task activated twice by Task 0, as Task 2 and Task 3:
   500  RECEIVE__VALUES__INTO R!,T!
   510  R!=R!/3
   520  T!=SIN(T!+5)
   530  PLOT R!,T!
   540  TERMINATE
```

Fig 3a

Figure 3a. A program which passes the values to local variables in a task. Multiple activations of the same task

some task defined from line 600 to line 800 uses local variable A!, and some other task between lines 1000 and 1250 uses a local variable A!, these two local variables, both having the same name, are actually two *different* variables. The one is only accessible in the second task. But this is just fine; the two tasks are separate.

You wouldn't expect the variables from one program to be accessible in another, so we wouldn't expect one variable local to a task to be accessible in another task. Of course, if we are good structured programmers, we normally would not use the same name for two functionally different variables anyway, but the point is you can and the computer recognizes them as different variables.

We need one more multi-tasking statement and we'll look at an interesting program. The statement has the form:

TERMINATE {task__number}

A 'terminate' statement, which appears within a task and which does not indicate a task number, simply terminates the processing of that task. It is somewhat like the 'return' statement in a subroutine except that it does not return to any other point in the program. A 'terminate' statement that does specify a task number (remember the task numbers set up by the 'activate' statement) causes the immediate termination of the specified task, even if that task is not yet finished (i.e., has not reached its own 'terminate' statement). Note that a statement such as:

830 TERMINATE 7

would terminate task number 7; it would not terminate the task which included statement number 830 (unless, of course, task number 7 happens to include statement 830).

You may recall that one form of the 'activate' statement allows a task to be activated without assigning a task number to it. The only way such a task could be terminated would be with its own 'terminate' statement. It could not be terminated by some other task using a task number-specifying form of 'terminate' (since there would be no task number to specify).

Look at the program in figure 3a, which shows a portion of a main program (task 0) and another, initially unnumbered task consisting of lines 500 through 540. This other task performs some calculations on two values and then plots a point on the CRT. Notice that this same task is activated by task 0 in two different places: at lines 55 and 80, and that it gives different task numbers each time.

Referring to figure 3b, we get a better idea of what is happening. At line 55 the statements 500 through 540 are activated as a task whose number is 2. We also pass two values, X and Y, to the task, which are received by the task into the task's local variables R! and T!. This means that the value of X (a global variable) is copied into the task 2's local variable R!, and the value of global variable Y is copied into task 2's local variable T!. After the activation occurs, we have two tasks being executed: task 0, which proceeds on with executing lines 60, 70, etc., and task 2, which continues on independent of task 0. Effectively we have told task 2 to go off by itself

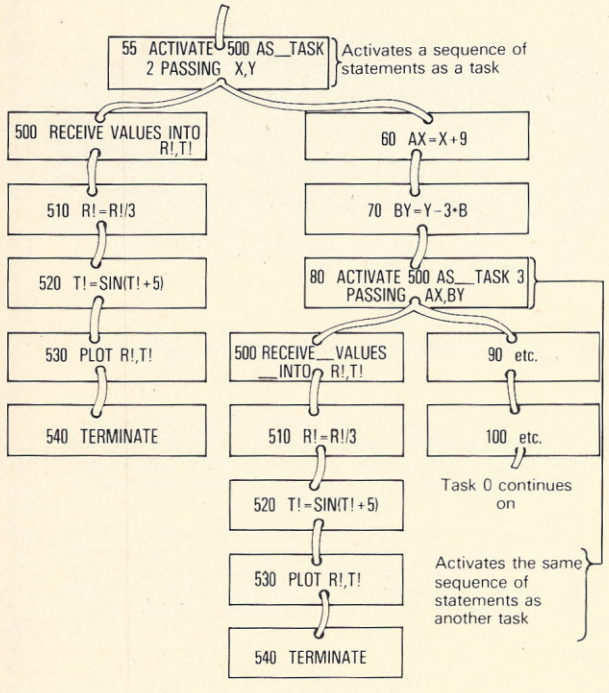

Figure 3b. Method of activating task 2

and do its job. When it gets finished, it will stop and we don't really care how long it takes to do its job, we just rest assured that it will do it. At the same time we, that is, task 0, will continue on with our own work on lines 60, 70, and 80.

But look what happens at line 80. We activate the same section of program (lines 500 through 540) as another task with a different task number! How can this be? We can't be sure that task 2 is finished processing its statements. But we don't have to. Indeed, it doesn't matter whether or not the other task is done. We can think of it as though the computer has made a second copy of the task between lines 500 and 540 and it is this copy that will be numbered and perform as task 3.

Notice, too, that we are passing different values to task 3. But remember that the local variables R! and T!, which receive the values in task 3, are different variables than the R! and T! that appear in task 2. So we can activate the same section of program as many different tasks all performing the same basic functions (in this case plotting a point on the CRT) but using different sets of data, and all performing at the same time!

In figure 4a we have a task which, among other things, calculates a value at line 850 in the variable Z7 (a global

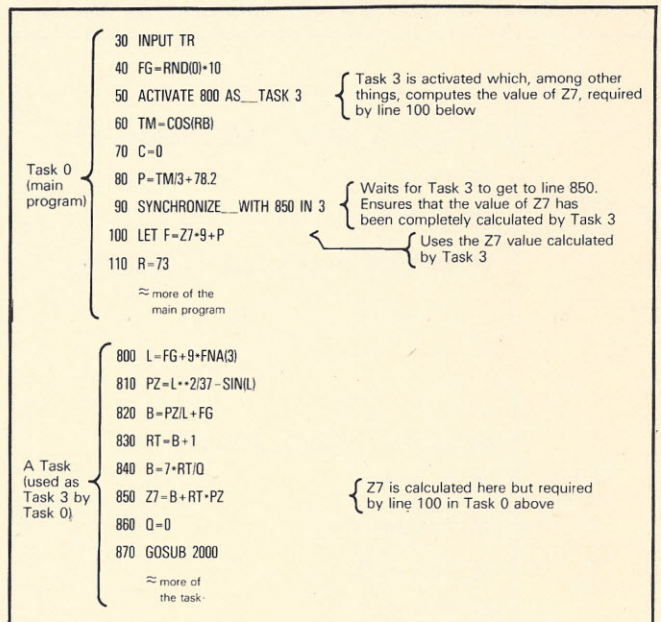

Figure 4a. A program requiring synchronization

variable) that is subsequently required by the main program at line 100. Obviously we need some way of ensuring that the task activated by statement 50 has gotten at least as far as line 850 (has calculated Z7) before the main program gets to line 100 (requires the value in Z7). We can ensure this with a 'synchronize' statement at line 90. This will cause the main program to stop executing (figure 4b) until line 850 in task 3 has been executed. So we are certain that the required value will be ready.

This is but one means of synchronizing tasks and is but one reason why we might need to synchronize tasks. The general format for the statement is:

SYNCHRONIZE_WITH line_number [IN_TASK task_number]

The optional task number specification is necessary in those cases where, as we saw above, the same section of code may be active as more than one task at the same time.

Another method of synchronization is with the 'wait_for' statement:

WAIT_FOR logical expression

An example of this is:

```
1020 WAIT_FOR X=3
```

which would stop the processing of the task in which the 'wait_for' statement appears until the logical expression X=3 becomes true; that is, until X is actually equal to 3. Again, for those used to sequential programming it may look like this statement would stop the program forever, especially if you had a sequence like:

```
1010 X=9
1020 WAIT_FOR X=3
```

until you realize that what we are waiting for is some other active task being processed to execute some statement set X equal to 3. At that point, the two tasks (the one waiting and the one set X equal to 3) would by synchronized, and the one with the 'wait_for' would then be free to continue on with its processing.

As a simple example of where you might use such a statement, consider a game program that displays a battlefield and occasionally displays a bomb burst. We will have a variable BB (for bomb burst) which, when incremented anywhere in the program, indicates that a bomb burst is to occur. Further-

more, we want the burst concurrent with whatever else is occurring. The bomb bursting task might look like this:

```
1000 WAIT__FOR BB>0
1010 LET BB = BB - 1
       ——
       code that actually displays the bomb burst
       ——
1350 GO TO 1000
```

Assuming that this task is activated somewhere near the beginning of the program, whenever any other part of the program performs a statement that increments the value of BB, such as 'let BB = BB + 1', the bomb burst task, above, will recognize it, since BB will indeed be greater than zero, and the burst will be displayed on the screen. Notice that the task decrements BB and checks, not for BB = 1, but for BB>0. This means that BB can be incremented any number of times anywhere in the program (each increment indicating a "request" for a bomb burst) and the bomb burst task will respond to all of them (albeit one at a time).

How, you might ask, can the computer do all of this multi-tasking business? How can it do more than one thing at a

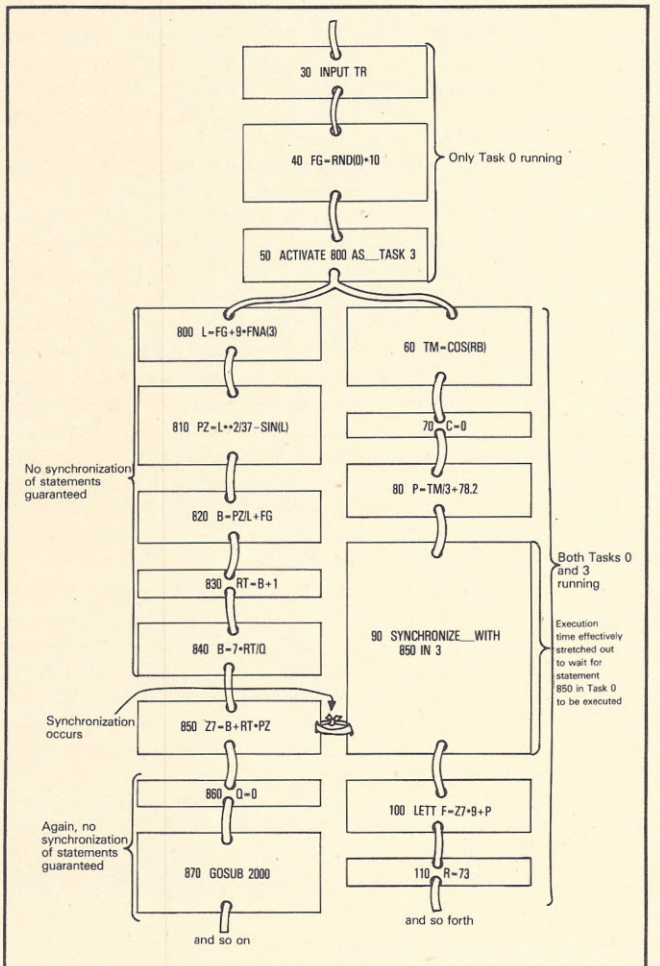

Figure 4b. A program requiring synchronization

time? How does it keep track of various tasks? And how does it know the difference between R! in one task and R! in another task? What you would be asking, of course, is for implementation details. And I'm glad you asked, because it will give me something to talk about next month.

In the meantime, I'd like to have your comments on what you think of the concept of multi-tasking Basic (after all, it does not yet exist; I am merely proposing that it would be an extremely valuable language). How would you change it? Do you like the statements and functions I have designed thus far? Do you now have a good idea of what multi-tasking is all about and would you opt for a multi-tasking version of Basic over the more traditional kind, were it available?□

Learning with Micros

by Louis E. Frenzel

Computer Literacy—Who Needs It?

There is a lot of discussion these days about just how much computer knowledge should be taught in school. Teachers, educators, manufacturers, parents and even the kids have all jumped on the bandwagon. Everyone seems so positive about the benefits of learning how computers work and how to use them. I'm enthusiastic, too, but I wonder if my own intense interest and extensive knowledge about micros doesn't bias my opinions. Aren't all of us in the field a little biased?

Perhaps all this is just blowing the whole idea out of proportion. Yes, micros have their place, but we need to reassess their real value. Just how important is it for our kids to know about computers? Should they learn how computers work? Even more important, should they be taught how to program?

The big issue today is in deciding between computer *awareness* and computer *literacy*. These terms have never been formally defined, nor their scope agreed upon. And we can rely on dictionary meanings only so far. So it's up to us to interpret.

If you read the literature, computer awareness means just that, being aware that computers exist, how they are used and how they affect our lives. Virtually everybody agrees that computer awareness is a good thing. The real question is, should we all be computer literates?

Literacy means well educated. More specifically, to be literate means to know how to read and write. In computer terms the word literacy is a bit fuzzier. Some people use it to mean broader or deeper awareness. To others, computer literacy implies being able to use and apply computers. In some circles, computer literacy means being able to program. Regardless of the meaning, computer literacy is more than just awareness.

To literacy advocates, the breadth and depth of knowledge of computers to be taught is far greater than just how they affect our lives. It will take a lot of time, effort and money to teach computing in the schools. The question is, should we?

Defining computer literacy

For our purposes, let's define computer literacy as being able to program and apply computers to specific applications. The goal of the instruction would be to enable the student to recognize and define a need or problem, determine its applicability to a computer solution, design an algorithm to solve the problem, then program and operate the computer to implement the system.

Well, obviously this can't be taught in elementary schools or even junior highs. Even to do it in high school may be stretching it. If you can keep the problems and examples simple but relevant, most high school kids can handle them. At the lower grades, some form of computer awareness program is certainly proper. At the college level, anything goes.

Now let's say that we will teach computer literacy in the high schools. First the pros. For starters, you won't have

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much trouble getting the student's attention. Most kids find computers interesting and challenging; and computers are fun to use. Second, a knowledge of computers will better prepare students for college and jobs. They will encounter computers in both places. Third, learning programming will teach problem solving, math and coding (a language). Everyone needs to learn a logical approach to problem solving. The most important part of the whole computer literacy exercise is probably the increased math skills that will be learned. As for coding, that's easy. It just involves memorizing rules and practice in using them.

Now what about the cons? The main issue is that if computer literacy is taught, what else will *not* get taught? There's only so much time in the curriculum and there are a lot of junk courses in high school today. I'm not saying that computer literacy is a junk course, nor that it's not worthwhile. But since schools are already doing a poor job presenting basic courses, would adding computer literacy further add to this problem?

Another issue is that of rapidly changing technology. A mere five years back, we did not have micros as we know them today. Neither did we have a lot of the neat technological goodies we now take for granted. Imagine what it will be like five years from now. We will be using a totally new generation of computers in ways we don't even suspect. Voice recognition and synthesis will be commonplace. Memories will be astronomical in size but extremely cheap. New software advances will make it even easier to program. In fact, maybe we won't even have to program to use a computer. Computers that can be programmed by voice are one possibility.

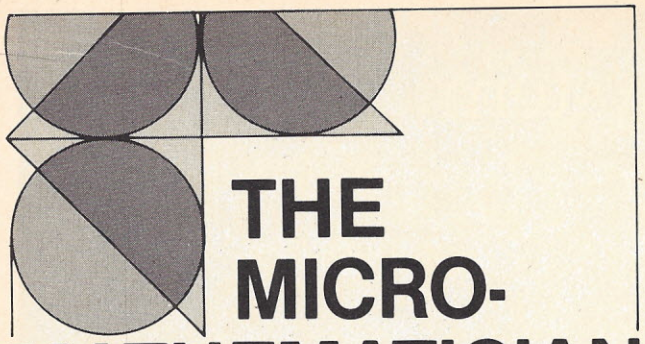
Should we teach our children subjects today that will be obsolete tomorrow?

Computer software that leads a user by the hand through a series of questions and decisions is being developed to eliminate, or at least greatly simplify, programming as we know it today. If these and other breakthroughs occur, won't most of that computer knowledge we plan to teach suddenly be obsolete? Should we teach our children subjects today that will be obsolete tomorrow? Maybe we should teach them a foreign language instead of a computer language. It will probably serve them better over their lifetime.

Finally, there is the problem of cost. To properly teach computers and programming, every kid must put in time by himself on a computer. Sharing a computer or terminal is just not effective. This means that the schools will have to buy thousands of computers. It could run into hundreds of millions or even billions of dollars. Where will all that money come from? More taxes?

Then there is the teacher training, again representing a significant investment of time and money. This is not to say we can't get the money or retrain the teachers. But is it worth it?

The issue of computer literacy won't be resolved overnight. More discussion will occur and we will see some testing and experimenting. Gradually we may see a solution evolve. □



THE MICRO-MATHEMATICIAN

by Douglas H. Haden

Arrays: Sequential Data Storage Part II

Last month Haden examined arrays, array operations and discussed how arrays are implemented in several compiler-level languages. Part 2 covers implementation of matrix arrays, and how to add an arbitrary number of dimensions to languages with as few as one subscript.

Implementing matrix arrays is more interesting than the implementation of vector arrays. If the base address of the I-by-J matrix M is b, the element M[i,j] is located at b + (i − 1) + (j − 1) × I for one-origin subscripting. This results in storage by *column order*—meaning all of column one is stored, then all of column two and so on—where the first subscript is called the *row subscript* and the second subscript is called the *column subscript*. Figure 1 shows the storage of a 3 × 2 array in column order. Element M[1,2] is located at b + (1 − 1) + (2 − 1) × 3 = b + 3. The *row order* formula is b + (j − 1) + (i − 1) × J would result in the storage sequence M[1,1], M[1,2], M[2,1], M[2,2], M[3,1], M[3,2].

So far, it has been assumed that vector and matrix elements require one address of storage each. If more is required, the formulas need to be modified. If we are storing an array of 2 bytes per element, the amount added to b would need to be multiplied by 2: the elements of the vector V would have their high-order byte at B + 2 × (i − 1) and their low-order byte at b + 2 × (i − 1) + 1. Element V[5] would be at b + 8 and b + 9. Similarly the elements of M would be located at B + 2 × ((i − 1) + (j − 1) × I) and that value plus 1. M[1,2] would be at b + 6 and b + 7.

The general one-origin array declared as A[I,J,K,...] has its element A[i, j, k,...] located at b + (i − 1) + (j − 1) × I + (k − 1) × I × J + (...) × I × J × K + ... (figure 2 for array A[4,2,3]). The formula can be extended to any number of subscripts.

Memory Address	Matrix Element
b	M[1,1]
b + 1	M[2,1]
b + 2 =	M[3,1]
b + 3	M[1,2]
b + 4	M[2,2]
b + 5	M[3,2]

Figure 1. Storing the 3 × 2 array M in column order

Some higher level programming languages provide only vector-type arrays. A similar limitation exists when, say, three-dimensional arrays are available and four or more dimensions are needed (for example the IRS tax table requires four dimensions: marital status, pay period, number of dependents and wage).

Memory Address	Matrix Element
b	A[1,1,1]
b + 1	A[2,1,1]
b + 2	A[3,1,1]
b + 3	A[4,1,1]
b + 4	A[1,2,1]
b + 5	A[2,2,1]
b + 6	A[3,2,1]
b + 7	A[4,2,1]
b + 8	A[1,1,2]
b + 9	A[2,1,2]
b + 10	A[3,1,2]
b + 11	A[4,1,2]
b + 12	A[1,2,2]
b + 13	A[2,2,2]
b + 14	A[3,2,2]
.	.
.	.
.	.
b + 23	A[4,2,3]

Figure 2. Column-order storage of the one-origin array A[4,2,3]

Vector-type arrays and subscripting formula are all you need to add arrays of any number of dimensions to a programming language. Figure 3 shows a four-dimensional array implemented in a vector-only Basic. Statements 100-150 are the equivalent of LET A(4,1,2,5) = 3.14159. This may seem

"Simple" Basic	Four-dimensional Basic
. . . DIM A(144)	. . . DIM A(4,2,3,6)
100 LET I = 4	100 LET A(4,1,2,5) = 3.14159
110 LET J = 1	.
120 LET K = 2	.
130 LET L = 5	.
140 GOSUB 1000	
150 LET A(D) = 3.14159	
.	
.	
.	
1000 LET D = (I − 1) + (J − 1)*4 + (K − 1)*4*2 + (L − 1)*4*2*3	
1010 RETURN	
.	.
.	.
.	.
2000 FOR I = 1 TO 4	2000 FOR I = 1 TO 4
2010 FOR J = 1 TO 2	2010 FOR J = 1 TO 2
2020 FOR K = 1 TO 3	2020 FOR K = 1 TO 3
2030 FOR L = 1 TO 6	2030 FOR L = 1 TO 6
2041 GOSUB 1000	2040 PRINT A(I,J,K,L)
2042 PRINT A(D)	2050 NEXT L
2050 NEXT L	2060 NEXT K
2060 NEXT K	2070 NEXT J
2070 NEXT J	2080 NEXT I
2080 NEXT I	

Figure 3. Adding a four-dimensional array to Basic

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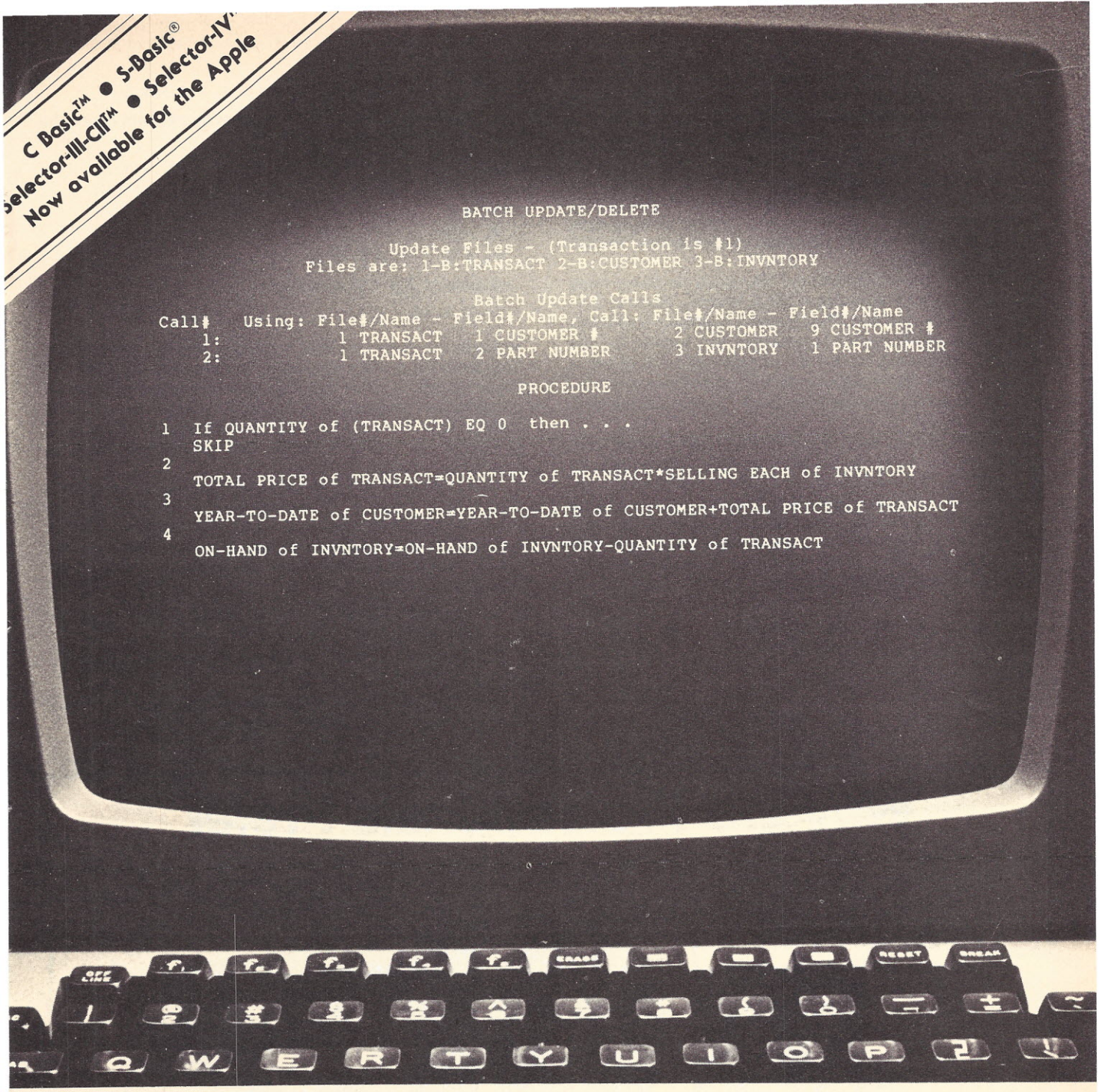

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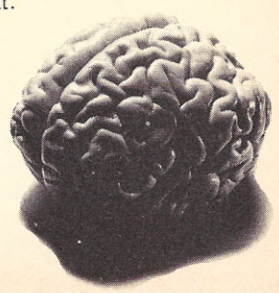

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verbose. However, printing the entire array (lower portion figure 3) requires only a small extra effort compared to a Basic that handles four-dimensional arrays.

As can be seen by counting the number of computations needed to determine the address of just one element of, say a three-dimensional array (six additions or subtractions and three multiplications), subscripts can be pretty time consuming. Several things can be done to increase the efficiency of array usage. For example, array statements (also called matrix statements) are available in many programming languages to substantially decrease execution time needed for array operations.

Fortran's array I/O statements will usually run many times faster than explicitly subscripted I/O statements. Statement 10 in figure 4 requires about 30,000 add and subtract operations and 18,000 multiplication operations not needed by the equivalent statement 20. Similar savings can be obtained in Basic by use of matrix statements. Vector and array-oriented languages such as APL can return even greater savings with array statements.

Another approach to reducing the overhead in arrays is to precompute as much as possible and eliminate redundant computations (for example once I × J has been computed, it need not be recomputed). Such precomputed values are called *strides* and all strides for a given array are called a *dope vector*. The dope vector for the three-dimensional array A with lower subscript bounds of lb_i and upper subscript bounds of ub_i for subscript i consists of strides s_0, s_1, s_2, and s_3:

$$s_0 = -1b_3 \times (ub_2 - 1b_2 + 1) \times (ub_1 - 1b_1 + 1) - 1b_2 \times (ub_1 - 1b_1 + 1) - 1b_1$$

$$s_1 = 1$$

$$s_2 = ub_1 - 1b_1 + 1$$

$$s_3 = (ub_2 - 1b_2 + 1) \times (ub_1 - 1b_1 + 1)$$

and, assuming element A[1,1,1] is located at base address b, element A[i,j,k] is located at

$$b + s_0 + i \times s_1 + j \times s_2 + k \times s_3$$

The strides for the 4 × 2 × 3 array of figure 2 are (since the lower bounds are all 1)

$$s_0 = -1 \times (2 - 1 + 1) \times (4 - 1 + 1) - 1 \times (4 - 1 + 1) - 1 = -13$$

$$s_1 = 1$$

$$s_2 = 4 - 1 + 1 = 4$$

$$s_3 = (2 - 1 + 1) \times (4 - 1 + 1) = 8$$

and element A[4,1,2] is located at

$$b - 13 + 4 \times 1 + 1 \times 4 + 2 \times 8 = b + 11$$

which is the same as we computed by the simpler formula. The benefits of the dope-vector formula are provision for lower bounds of other than one and the reduced number of computations needed to compute subscripts. Only 18,000 addition operations are required by statement 20 of figure 4 if computed by the dope-vector formula—half as many as needed previously.

The inverse of the subscripting formula is frequently useful. For example, if you are looking at a memory dump and want to know which element of an array is located n locations beyond the base address of the array, you compute the specific element's subscripts for the following (for the three-dimensional case):

1. compute q_1 and r_1 as the quotient and remainder respectively of n ÷ (I × J),
2. compute q_2 and r_2 as the quotient and remainder of r_1 ÷ I, and
3. the array element A[i,j,k] is located at b + n, where i = r_2 + 1, j = q_2 + 1, and k = q_1 + 1.

```
      DIMENSION A(10,20,30)
   10 WRITE ( . . . ) (((A(I,J,K),K = 1,30),J = 1,20),I = 1,10)
      .
      .
      .
   20 WRITE ( . . . ) A
```

explicit-subscript and array I/O statements in Fortran

```
   50 DIM A(20,40)
      .
      .
      .
  100 FOR I = 1 TO 20
  110 FOR J = 1 TO 40
  120 LET A(I,J) = 0
  130 NEXT J
  140 NEXT I
      .
      .
      .
  200 MAT A = ZER
```

explicit-subscript and array statements in Basic

Figure 4. Explicit-subscript v. array statements

Thus for the array declared as A[4,2,3], the element located at b + 11 is

1. $11 \div (4 \times 2)$ yields $q_1 = 1$ and $r_1 = 3$,
2. $3 \div 4$ yields $q_2 = 0$ and $r_2 = 3$, and
3. $i = 3 + 1 = 4$, $j = 0 + 1 = 1$, and $k = 1 + 1 = 2$

or element A[4,1,2], which agrees with figure 2.

Finally, array operations that interface an array with the environment external to a program (such as pass it to an assembly language subroutine or read its values in from an I/O device) must follow some prearranged convention as to element order. There was a time when some Fortran compilers transmitted the elements of an array in column order and others would transmit the elements of the same array in row order.

Data order varies

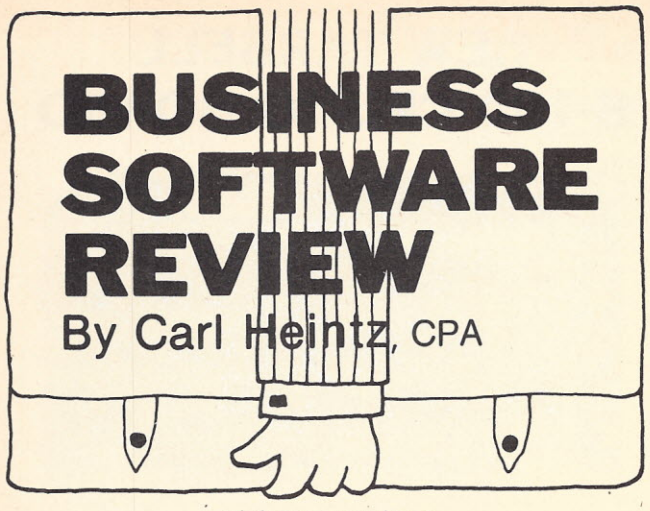
Thus if an array has two or more subscripts, the same Fortran array 'write' statement prints data in one order on one computer and in another order on a different computer. To overcome this, the American National Standard for Fortran stipulates that arrays will be transmitted in the order they are stored and that should be in column order. Full standard Fortran permits arrays with up to seven subscripts.

Hence the characteristics of the most frequently used data structure in computer programming—the array—include both space and time efficiency, the latter being enhanced when dope vectors or, better, array statements are used. While virtually all programming languages provide some sort of array capability in what is generally called subscripted variables, the variety of syntaxes and subscript interpretations and constraints are substantial.

We frequently desire to implement arrays either in a higher level programming language that doesn't have as many subscripts as we need or in machine language. The formulas presented do this. Algorithms have also been given for finding the inverse of the subscripting formulas and for handling subscripts that are negative or of a specified lower-bound/upper-bound range. □

BUSINESS SOFTWARE REVIEW

By Carl Heintz, CPA



Visicalc examined

One of the most innovative pieces of software to come along in quite a while is the Visicalc package from Software Arts, Cambridge, MA. The program is designed for the Apple, TRS-80 and now the PET CBM. To effectively use the program, at least 32K of program space is required, at least one disk, and a printer is recommended.

Visicalc is basically a set of programs that transforms the computer into an "electronic sheet" on which the user places headings, column numbers and row numbers. The computer's screen becomes a window that looks out upon a much larger "sheet." The user can move the window to examine various parts of it, and can even split the screen to look at two different parts at once.

This electronic sheet is like a piece of graph paper—with thousands of x and y coordinates. At any of these points, the user can enter titles, numbers, or formulas. The power of Visicalc, and the feature that makes it unique, is the ability to have the computer use the formulas and calculations to create forecasts, budgets, plans and projections. Further, with a few keystrokes, the program can be instructed to alter the projections. All formulas and projections will be recalculated based upon the new information. Thus it is possible, for example, to create a cash forecast, run it, change it, rerun it several times in the time that it would take to do one calculation manually.

The program allows the user to save formats for future use or modification. Of course, the results can be printed out. Anyone who has had to prepare any form of financial forecast, or apply for a bank loan, or prepare budgets will appreciate the power of Visicalc. Compared to manual methods, the program will literally save days.

Visicalc is a combination of a language, a word processor, and a calculation program. It uses its own conventions and symbols to represent the system commands and syntax. An example of a command might be:

/irmonth – /fr.r:c2.m2@

or

/f$ + b15/12*a17

At first the command sequence seems a bit confusing, but the manual takes the first-time user step-by-step through the process, starting from turning the computer on, so that by the fourth "lesson," the user is comfortable with the syntax as well as the commands.

Much confusion is eliminated by the dynamic display of results as the commands are entered. And, to comfort the clumsy user, there is the comment by the programmers that it is virtually impossible to cause damage to the program and any damage to the project in process is easily reversible. Many such instances are given in the manual, which forgivingly assumes that the user has two left feet instead of hands.

The Visicalc program and operating system utilize about 25K of memory. Since the program is written in assembly language, there is no lost memory. However, on a 32K machine, that leaves only about 6K for the user data. Fortunately that is more than sufficient for most applications. The program dynamically allocates space as is needed.

Large line capacity

There can be up to 254 lines, and a maximum of 63 columns. However, there is no way to have a 254 line by 63 column format, since that would require, assuming a 9-digit number for each slot, about 145K of memory. Lest the user be concerned about running out of space, the system has a memory indicator that constantly indicates the amount of free space available. Since memory is dynamically allocated, the user need not be concerned with it other than to insure that his application is within limits.

Some Visicalc features include:

- ability to replicate columns or numbers within them from one column to another or from one row to another
- ability to fix titles of rows and columns so that as data is scanned, the names of the rows and columns do not leave the screen
- move feature allows one to move numbers around on the sheet without re-typing them
- automatic percentage calculation
- command to count the number of items, which can be used in the analysis as a variable
- sum command can sum columns, or rows or parts of either
- absolute value command which translates all numbers to positive numbers
- integer command that truncates all numbers to be even integers (example 7.50 becomes 7)

The sum command sums a column or a row or part of either. With the min, max and average commands, a user can

calculate the minimum, maximum and average of a set of figures. For example, in a cash flow analysis, where each column represents a different month, and each row is a component in the calculation of cash flow, the program could give a multimonth calculation of cash flow, indicate the maximum amount of cash that will be available at any month end, the minimum and also the average cash balance.

The 'na' command sets up a screen and runs it with incomplete information. Assume the user had a budget, but was missing the amount of the insurance premiums. By placing 'na' in the column where insurance was to go, the user could execute the remainder of the program. Wherever insurance was used, an 'na' would appear.

Strong support for functions

The edit functions and view functions are well supported. For example, the program allows the user to view more than one part of the electronic sheet at the same time. The screen can be divided horizontally or vertically, and allows an uneven split. The user can view the first few columns of a projection, the last column and dynamically make changes to the assumptions in the first column while viewing the result on the last column.

Formatting of numbers is especially important in the case where numerous calculations will be made. Unfortunately, many programs do not allow for different types of numbers within the same analysis. Not so with the Visicalc program. There are provisions for global assignment of formats, and individual number formatting at the same time.

Programs include utilities such as the ability to prepare a net present value calculation, especially useful for examining an investment opportunity and forecasting the net return on investment. One example of how this might be used is in the case of a real estate investment.

The rental income and expenses constitute the row designations, with net cash flow after debt service as the bottom line. Utilizing the columns as months or years, a model can be constructed for forecasting cash flow. The NPV function can be invoked to determine what the net present value of the investment was, given an interest rate. The beauty of the system is that once it is set up, the user can ponder the "what ifs" and immediately see the result.

One difficulty, however, is the inability to reference to another data source. For example, suppose a user was designing an income statement forecast. One important aspect would be the income tax expense; an expense that depends upon the level of income and is not just a simple percent of that income. With Visicalc, a user can employ the "lookup" command to allow a reference to a separate table of numbers—the tax rate schedule in the case here.

Graphics capability included

Scientific notation is supported, as are the transcendental functions. These include sine, exponentiation and logs. Unfortunately, no calculus functions are included.

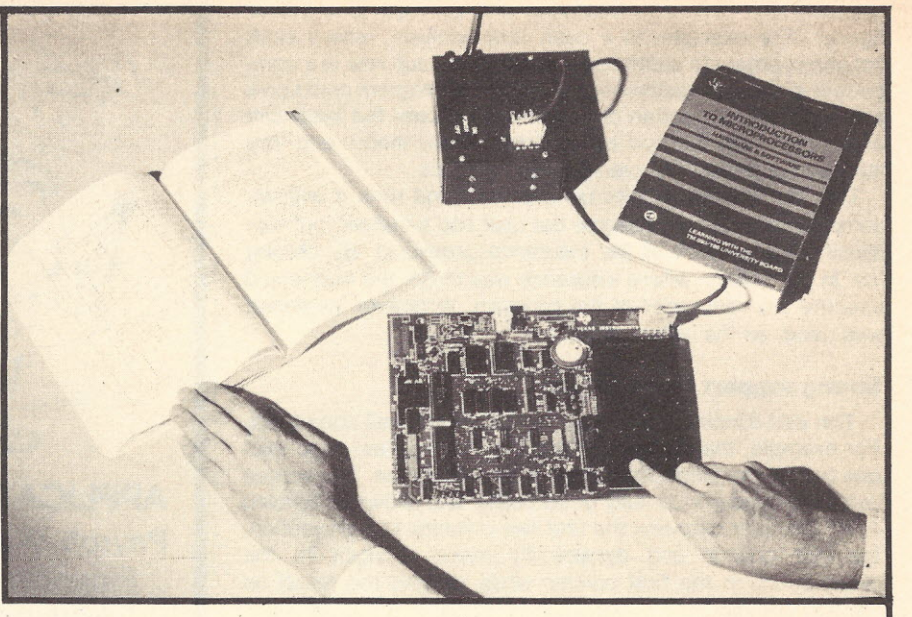
One of the outstanding features of the program is its built in graphing capability. The user can easily create simple but usable bar graphs...a feature not found in any comparable software.

The manual is outstandingly designed for the novice user, with the first part devoted to a tutorial that leads from the first step to completion of a complex program. To make things even more logical, there is a flowchart of commands, what they do, and how they interrelate.

Overall it is an outstanding achievement in micro software. The novice user will, however, have to spend four or five hours experimenting with the program to achieve any sort of comfort with the syntax and the commands. Occasionally, users expect that they can "plug and run" with a software package. With Visicalc, there will be some start-up time expended, but it will be more than rewarded with the amount of time saved in producing outstanding reports. □

System of the Month

TM 990/189



Classroom Fundamentals on a 16-bit Micro

by Ralph Tenny

Over the past several years, microprocessors have become so popular that there is a large need for personnel trained on them. Most early courses used available hobby computers or microprocessor development modules for classroom hardware. Since the existing hardware was not intended for classroom work, it was often necessary to construct additional support devices to serve as programming examples.

The TM 990/189 University Module by Texas Instruments was designed to meet this need. It was intended for classroom training on the assembly language of the TMS 9900 microprocessor. To aid the instructors, the University Module has built-in programmable peripherals such as LED indicators and a solid state annunciator.

Operator controls include a calculator-type keyboard that produces all printable upper case Ascii characters on a seven-segment LED display so we can follow the action. Unibug, the easy-to-use monitor program, is located in ROM and includes a single-pass symbolic assembler, allowing us to key in programs in assembly language similar to one that a full TI 990 minicomputer would use.

In addition to the on-board Ascii terminal and display, we can use the system with standard external terminals at 110 and 300 baud if we add some parts to the basic board. The keys on the external terminals work the same as the keys of the on-board terminal, so there is nothing new to learn.

The page-sized (8.15 by 11 inch) module comes with 1024 bytes of read/write memory and has sockets for an additional 1K byte of read-write memory. Other features include a power supply (available as an accessory) and two valuable instruction manuals: one explains about the computer. The other is a college-level textbook on microcomputer basics and material specific to this series.

The Unibug monitor is a 4096-byte masked ROM, and another onboard socket will hold either a 1K-byte Eprom or a 2K-byte Eprom for any other programs we might need. These programs are entered by using a single keystroke. The expansion memory space has been planned so we can easily expand memory off-board in an 8K block of memory that can be addressed in one section.

We can make real-world connections easily by using the unique communications register unit. The CRU is a versatile high-speed serial I/O device adapted from TI's 960 and 990 minicomputers. The CRU allows us to do almost all types of I/O interfacing by using five special CRU instructions to address individual I/O locations. These CRU instructions will test individual bit locations or turn bits on or off one at a time. Few microcomputers are so easy to work with.

No limit to registers

No general purpose registers are included on the processor. Instead, we have an almost unlimited number of registers available; we can use a different set of registers for almost every program section if we want to.

These registers are located in memory and we keep track of the registers by using a workspace pointer, which is on the processor chip, as are the status register and program counter. The general purpose registers are arranged in blocks of 16 memory locations for each workspace we assign, and the workspace pointer is always pointing to register R0. Whenever a new workspace is needed, we use a special instruction to assign a new workspace pointer location.

Normally we can use any of the registers for any register function, except that R0 may not be used as an index register. Since all program data activity occurs in either the current workspace or in memory buffers, our program can make a complete change or jump to subroutine (called a context switch) very quickly if we assign another workspace pointer location.

The CPU saves the current values of workspace pointer, program counter and status registers in R13, R14, and R15 of the new workspace and begins program operation at the new location. A return context

switch is done the same way, so that interrupt response for a 9900 is fast and efficient.

The set has 69 basic opcodes and eight addressing modes. The addressing modes are:

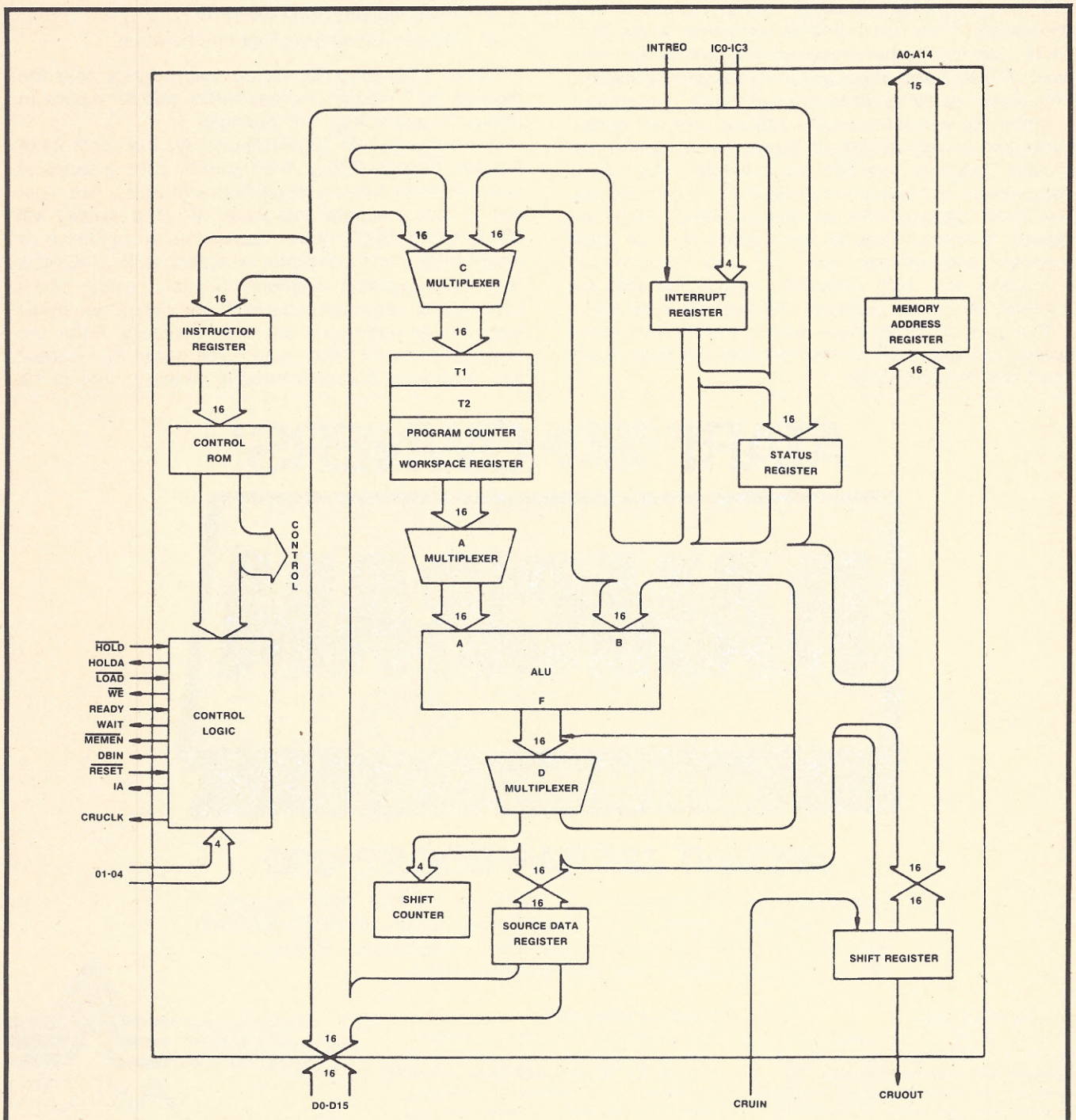
- Register-to-register
- PC register
- Indirect register
- Indexed indirect autoincrement
- Symbolic addressing, non-indexed
- Symbolic addressing, indexed
- Immediate addressing
- CRU addressing

This instruction set features memory-to-memory operations allowing us to work with either byte or word quantities. We find many logic instructions to examine individual bits or various bit combinations. The special I/O instructions which address the CRU port let us change single bits anywhere in the CRU space.

The status register is a full 16-bit word; five status bits are more familiar. The first three status bits are set by comparing the data produced by the instruction to zero.

Five status bits are reserved for use in TI's larger minicomputers, and two more status bits are the odd parity (set only by byte instructions) and the XOP bit, which is set by an extended operation or subroutine call that we can write for special tasks. The four least significant bits in the status word make up the interrupt mask.

The interrupt mask lets us assign a priority to each of 16 interrupts, so that a device's access to the CPU is



Architecture of TMS 9900 microprocessor allows for 16 workspace registers.

governed by how important that device is. Any device must have a priority equal to or greater than the mask value in order to interrupt the processor.

Our program decisions are made by 12 conditional jump instructions, so we can make efficient programs.

The data manipulation instructions of the 9900 allow us to move either a word or a byte to any machine location, swap bytes within a word, load registers with immediate values and shift the contents of any register left or right.

Two exceptions to shift count

The 9900 shift instructions work about as we would expect, with two special exceptions. First, 9900 shift instructions can move data from one to 16 positions with one instruction. Second, the shift count is programmable if we use a special provision of the shift count. Like most other processors we are familiar with, each bit that is shifted out goes into the carry status bit. This allows us to do bit testing with shift instructions.

Arithmetic instructions let us add and subtract words, bytes and immediate values, increment or decrement register contents and find the absolute value, one's complement and two's complement of 16-bit numbers. The 9900 family can also multiply and divide 16-bit unsigned numbers. Logical instructions set or clear registers and perform 'and', 'or' and 'exclusive-or' operations with both immediate values and with the contents of various registers and memory locations.

The unusual architecture lets us use three kinds of subroutine calls: XOP, Branch and Link and Branch and Load Workspace Pointer.

The easy-to-use monitor has single-key commands which let us use the following operational and program debug functions:

- C Inspect/change CRU bits
- F Inspect/change status register
- M Inspect/change memory locations
- P Inspect/change current PC value
- R Inspect/change workspace register value
- W Inspect/change workspace pointer
- D Dump object code to tape
- E Execute program beginning at current PC value or execute to breakpoint
- J Jump to program resident in expansion ROM socket
- L Load memory from cassette
- S Single-instruction program operation

These commands let us do many things with the module. RET means to press return and SP means to press the space key. For example:

The command (M 200 RET) displays the contents of memory location 200_{16}. If we want to enter a series of new values in memory beginning with 200_{16}, we must key in the new data and press SP. The display will show: 0202 XXXX. (XXXX represents an unknown or random value and is the data in location 202_{16}.) 0202 is the next available memory location, since 16-bit machine op codes and operands are always two bytes long and all addresses are even numbers. Enter the new contents for 202_{16} and again press SP. Repeat this sequence, stepping through memory, until all the

data is entered. Memory modification is ended by using RET after the last value, and if the contents of any location are correct, simply use SP to go on without entering any new value. The rest of the inspect/change instructions (C, F, P, R and W) are single-location commands and are simply terminated with RET.

Once your program is entered, check it by using this key sequence: M 200 RET. After location 200 is displayed, repeatedly press SP until the last of the new data has been displayed. With the new program entered, use the debug commands to verify program operation.

First, since we entered the machine code directly instead of from cassette tape, we must initialize the CPU registers. P RET will display the current PC value, and 200 RET will enter the program starting address into the PC. Also the same type of key sequence using W and F commands will set the workspace pointer and status register values, respectively. For initial operation, we should set the SR to 0000_{16}.

Watching for entry errors

If the program execution is begun by using E RET, the processor will begin operation at the location we set using the P command. If you used a good program and entered it correctly, then all is well. However, with a new program or a long program subject to entry errors, it is better to use S RET. With this command, our program will be executed one instruction at a time, and the display will show the address of the next instruction to be executed. At any time during single-step operation, we can examine the current contents of the workspace registers and the status by using the R(Y) and F commands respectively.

Another debug command is 'execute to breakpoint'; with the command E 24C, the program will execute until location $024C_{16}$ is reached. The display will then read BP 024C, and we can then check workspace registers, status, etc., until we are sure the program has operated correctly. After the program has operated correctly, it is wise to record the program on cassette tape.

If a program is currently in memory and has been debugged, the D command allows us to make a cassette tape copy of the program for future use. The keyboard syntax we need reflects TI's practice with its larger computers; we must record considerable data on tape with the object code. The addresses of the first and last bytes of program code, the program counter value where the program execution begins, and a six-character program name all are part of the command. When the tape is later loaded into memory, the program name is displayed if the load is successful.

Finally, new programs can be entered in 9900 assembly language by using the on-board symbolic assembler. This program (part of the Unibug monitor) "understands" assembly code entries and enters the corresponding machine code directly into memory.

By using the user I/O port of the TM 990/189, we can do many kinds of sensing and control with minor additional circuitry. If the device we are trying to control does not require all data bits to come true simultaneously, the user's I/O port gives us 16 bits of external sense and control function. The port actually has provisions for interrupt signal inputs, which often are not used. So, careful choices of pin functions can give us 16 I/O pins which can serve as either input or output, and six more pins which are input only. □

Low-Cost Aid for Turnkey System Development

Pragmatic Designs' DBM-1 Debug M

by Roger H. Edelson

A number of us computer hackers actually use microprocessors to develop "turnkey" or special purpose systems for sale, or as part of a larger piece of equipment. This, besides dedicated hardware configured for the specific task, requires a thoroughly debugged program resident in Prom or ROM. Since hardware and software development are interactive, there should be some method to quickly change the software stored in the ROM space as development progresses.

A Prom traditionally solved this problem, but system development is greatly impeded by the requirement to erase and reprogram the Prom as software is changed. What is needed is a memory that can be easily updated or changed during operation, but cannot be inadvertently overwritten by the development hardware.

Pragmatic Designs, Inc. (Sunnyvale, CA) has a device, DBM-1 debug memory, that allows just such quick, nonpermanent modifications without the danger of program loss. This board is an S-100 bus-compatible card that allows simulation of the ROM (either ROM or Prom) in the turnkey or target microcomputer system through the use of static memory integrated circuits resident in the development computer system.

The DBM-1 uses standard 2114 1K by 4-bit, 300 nsec. static RAM circuits to simulate up to 2K bytes of Prom or ROM in the target computer. The table lists the different Prom/ROMs that can be simulated by the DBM-1. As mentioned, one debug memory card can simulate up to 2K bytes of memory, but not all of this capability need be utilized—it is possible to simulate only a 1K Prom/ROM chip, if desired.

There is, however, a limitation with regard to memory speed. As the debug memory uses 300 nsec. RAM circuits, it is not possible to simulate the faster, high speed bipolar technology memories. There is, though, no restriction on size; if the user finds it necessary to simulate more than a 2K block of memory, additional DBM-1 cards may be added as required.

An additional design feature is a software control over the size of memory that the debug memory simulates. This is useful if the DBM-1 is used with a number of different target systems and it is not convenient to allow access to SW2-D normally used to set the size of the simulated Prom/ROM. The selection of ROM size is then determined by the state of bit 15 of the data stored in the trap address location.

In order to use the DBM-1, the S-100 computer becomes the software development system that writes the desired program into the debug memory address space under program control. The target microprocessor then reads data out of the debug memory by inputting its own memory addresses and chip selects just as if the memory resides in the address space of the target hardware.

Partial list of Prom/ROM devices simulated by the DBM-1

2708, 2708L, 2708-1	1024 x 8 UV Erasable PROM
2758	1024 x 8 UV Erasable PROM, single +5V supply
2308, TMS 4700	1024 x 8 MOS ROM
2608	1024 x 8 Factory Programmable PROM
TMS 2716	2048 x 8 UV Erasable PROM
2716, 2716-1, 2716-2	2048 x 8 UV Erasable PROM, single +5V supply
TMS 2516	2048 x 8 UV Erasable PROM, single +5V supply
2316E	2048 x 8 MOS ROM
2616	2048 x 8 Factory Programmable PROM

It is not necessary that the target microprocessor be the same as the one in the S-100 development system, or that it even be an S-100 bus system. The timing of the use of the memory by the target microprocessor is only dependent upon its hardware design and choice of processor and interface integrated circuits and the timing constraints of the expected Prom/ROM chip.

There is no interrelation with the timing operation of the host or development computer. Of course, a memory contention problem could arise if the S-100 system and the target hardware both tried to access the same location or any portion of the debug memory

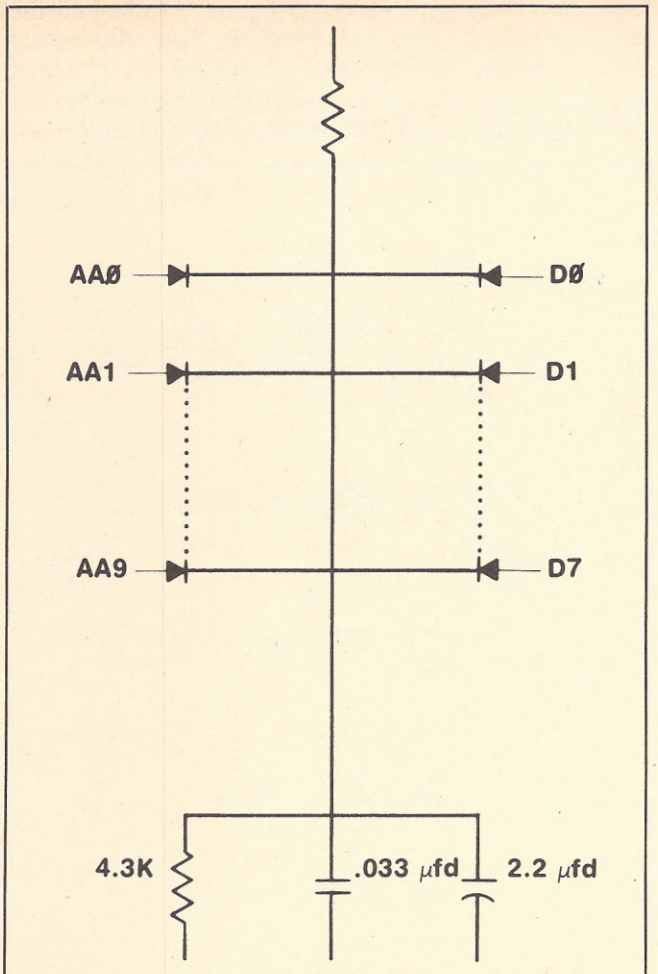


Figure 1. Passive termination

address space at the same time; but actual conditions of use preclude this.

When not using the debug memory to simulate Prom/ROM space in the target system, memory space is not lost to the host computer. It may be accessed just as if it were normal memory. By the same token, when this memory is being used, the S-100 bus micro can be used for assembling, listing, or executing other application programs. As the write enable (WE) pins of the debug memory's 2114s are not available to the target microprocessor system, it is not possible for this hardware to alter the contents or programs stored in the static RAM.

The debug memory acts like a ROM circuit. From the other side of the fence, however, the write enable lines are available to the S-100 bus processor and can fully utilize the memory space as if it were normal RAM.

As an aid to program development, the debug memory contains a hardware address trap located in the two highest memory locations, a flip-flop on the DBM-1 is set. This is signaled by both an LED indication on the DBM-1 plus the availability of signal on the 16-pin interface cable and on the connector P-2, which indicate the status of the trap flip-flop. The trap flip-flop is not reset until the next access of the debug memory by the S-100 bus host system.

To avoid writing the trap address in the middle of a block of memory when more than one DBM-1 is being used, provision has been made to daisy chain the trap logic. In this case, it is only necessary to write the trap address into the top two locations of the highest address in the 4K or larger block. Provision has also been made for providing a qualifying signal for the trap logic where the simulated Prom is part of an array on a memory board.

Switches (SW2-B/C) provide that the trap address sampling may be changed from the usual "leading edge" sample to a "trailing edge" sample, if required. In this case, leading and trailing edges refer to ROM chip's "chip-select" control signal.

Keep cable lengths short

Depending on the amount of memory to be simulated, the card is interconnected to the target system through either one or two 24-pin jumper cables. Cable lengths up to three feet may be used reliably, even with an unbuffered system, depending on the capacitive loading and the timing margins designed into the target system. To reduce crosstalk and ringing, the DBM-1 includes a passive terminator; for reliable operation, interconnecting cable lengths should be kept as short as possible. The passive terminator is not similar to the ones usually used for reducing ringing on S-100 bus lines.

In this design, all signals are connected to a single node through diodes (figure 1); it should do a reasonable job on signal overshoot but negative going spikes will not be clamped as the diodes are reverse biased. If the user finds his target system does not possess enough capacitive driving capability or timing margin to use the interconnection cables as is, a circuit is provided to buffer the address and data lines (figure 2) and may also be used if it is necessary to employ interconnecting cables longer than one meter.

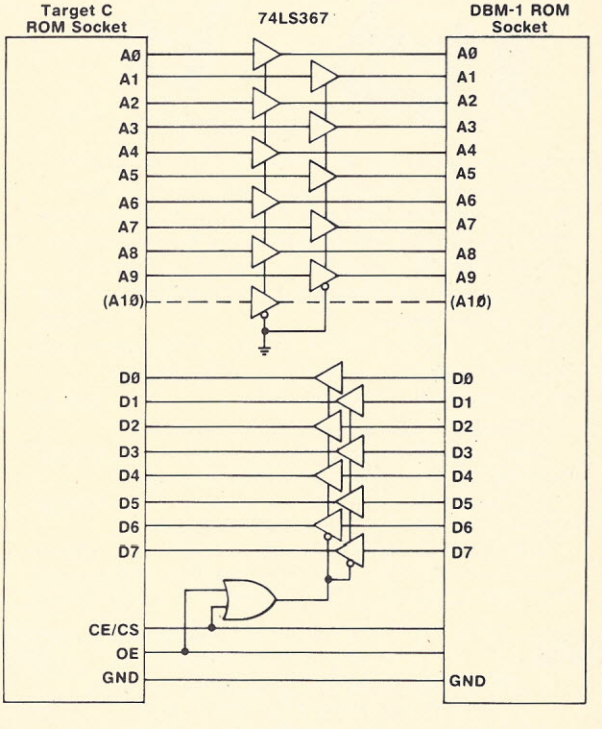


Figure 2. Buffer board

A block diagram is shown in figure 3. Note that the card consists of five major blocks. The card select block contains circuitry that allows the 2K of static memory to be located on any 2K boundary within the entire address space. The ROM being simulated may,

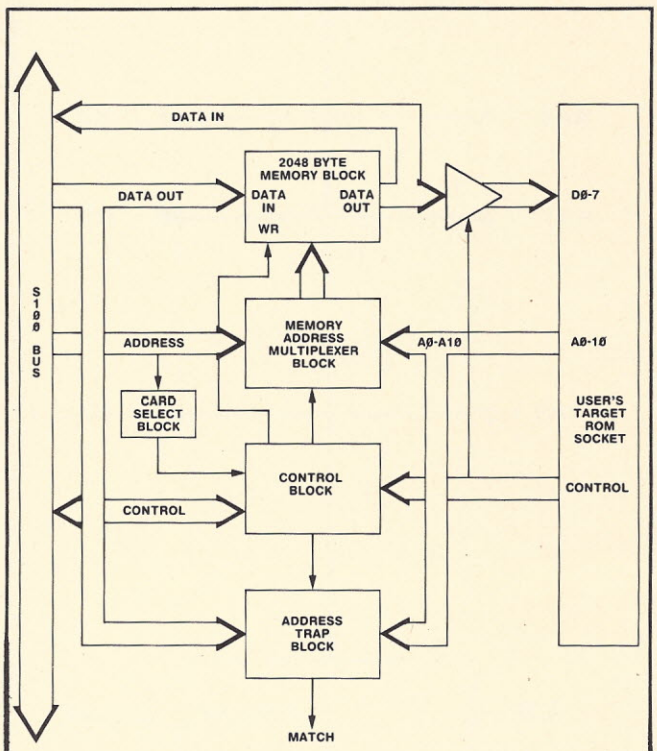


Figure 3. Block diagram

of course, be located anywhere within the address space of the target microcomputer, without regard to its location in the S-100 bus address space.

The selection of the 2K boundary within the S-100 address space is done by jumpers or a switch. On the board I received, the jumper area had a socket to accommodate either a switch, or a 16-pin jumper header. The design requires that many of the various S-100 bus signals be used in multiple places on the board. In order to meet the loading requirements of the tentative S-100 bus standards, the manufacturer has buffered those signals that have multiple usage, a choice with which I heartily agree.

Because of the complexity of some of the logic, it is necessary to force the S-100 bus system into "wait states" in order not to violate timing constraints of the S-100 system. Normally two wait states are required, but if only one wait state is sufficient, a switch (SW2-A) is provided to allow this option.

The physical design and construction of the DBM-1 is excellent and evinces a high standard of workmanship. The S-100 bus edge connector is gold-plated for reliability and the board markings are clear and readable. On my board, approximately 60% of the integrated circuits were socketed, while the others were soldered. I really don't understand the logic behind this. In some, an LS02 was placed in a socket, and in another location the same chip was soldered. For ease of servicing, I prefer all integrated circuits be socketed, and I'm willing to pay slightly higher for it. As it is, the DBM-1 is not an expensive board, retailing for less than $200. □

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CIRCLE INQUIRY NO. 16

Sounds of the Atari ♫♪ in Basic

by Herb Moore ©

This series provides the novice programmer with the fundamentals of the Atari Basic language to generate sounds and music on the 400 and 800 computers. No prior knowledge of music is required and, read in sequence, it reveals tools necessary for truly creative music programming.

In order to get an Atari to generate sounds, you must enter a 'sound' statement consisting of four variables: V (for voice), N (for note), T (for tone) and L (for loudness).

The form of the 'sound' statement is:

```
SOUND V,N,T,L
```

In this form, the statement is a *direct command.* Let's give the variables some numeric values (to be explained in a moment). It looks like:

```
SOUND 0,121,10,8
```

It is important to separate each variable in the statement with a comma. If you type this command and press the 'return' key, the machine will produce a single sustained tone that is approximately middle C in pitch. This note will continue until you press the 'system reset' key to stop it.

Here's what the statement has told the machine. The first variable V turns on the sound for one of it's *four voices.* Since computers start counting from 0, the voices are numbered from 0 to 3.

There are actually 256 note values available (numbered 0 to 255). But the machine is able to produce several other notes as well. If, for example, you entered the value 119 for the N variable in the 'sound' statement, it would produce a note somewhere between middle C and C#.

The next value in the statement, 10 for T, is one of 16 tones available in Atari Basic (numbered 0 to 15). This particular value provides a fairly "pure tone" whereas you might encounter some rather unusual sounds if you try some other values for this variable. We'll look at some of these tones more in later articles as you begin to program some special effects.

The last value in the statement, 8 for L, represents a medium level from one of the 16 levels of loudness (numbered 0 to 15).

A direct command is useful if you wish to have the machine perform some simple operation one time. However, if you've tried some different values in the 'sound' statement, you may tire of typing the statement over again. Here's a way to accomplish this with a simple program that can be repeated. Type the statement above but give it a line number:

```
10 SOUND 0,121,10,8
```

This tells the machine that this is part of a program rather than a direct command. When you now press 'return', it enters this line into the computer's memory to be used later. If you run this program at this point, you probably won't hear anything. When the machine runs a program, it stops when it comes to the end. In this case the machine turns the tone on and off so fast that you would likely not hear it. In order to sustain a note as before, add the line:

```
20 GOTO 10
```

and press 'return'. (After typing a line, always press the 'return' key to enter it into memory.)

This line tells the machine to go back and reexecute line 10, thus forming a loop that sustains the note. Now, in order to have the computer execute this program, type 'run' and press 'return'. This will produce the same sustained tone as before until 'system reset' is keyed to stop the program. Although you had to type in two lines to accomplish the same thing with a program, the advantage is that you can run the program again by typing 'run' and pressing the return key.

Since the computer executes commands very quickly, we often find it necessary to tell the machine to pause briefly before going on to the next command. This is especially important in music since we often wish to vary the length of different notes or rests. The way this can be done is to have the computer count for a while before going on with the 'for-next' loop. If at line 20, instead of having the machine go back to line 10, we add a 'for-next' loop, we get:

```
10 SOUND 0,121,10,8
20 FOR W = 1 TO 200
30 NEXT W
```

Lines 20 and 30 tell the machine to count from 1 to 200. If you run this program, you will hear how long it takes for the machine to count to 200 since the tone will be sustained that long and the machine will turn off the tone. By substituting different values for the number 200 in this program, you can explore some different durations for the tone.

You can also use a 'for-next' loop to change the value of one of the variables in the 'sound' statement. Suppose, for example, you wanted the note to start very softly and increase in loudness. This could be accomplished with:

```
10 FOR L = 0 TO 15
20 SOUND 0,121,10,L
30 FOR W = 1 TO 100:NEXT W
40 NEXT L
```

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CIRCLE INQUIRY NO. 72

Line 10 tells the machine to begin reading the first 16 values for L.

Line 20 tells it to enter that value in the 'sound' statement.

Line 30 is the time delay again telling the machine to stay at L = 0 while it counts to 100. (We take advantage of Atari Basic's ability to include more than one statement in a given line by separating statements with a colon.)

Line 40 tells the machine to enter the next value of L until all 16 values have been played.

If you wish to hear the notes in the octave above middle C, you can write a program using the following 'for-next' loop:

```
10 FOR N=60 TO 121
20 SOUND 0,N,10,8
30 FOR W=1 TO 100:NEXT W
40 NEXT N
```

You might be slightly surprised to hear that the sequence of notes descend in pitch even though the values of N ascend from 60 to 121. Remember that the numeric values for N are inversely related to the pitch of the note. So it's actually playing C above middle C down to middle C. In order to play the same octave in ascending sequence, change line 10 to:

```
10 FOR N=121 TO 60 STEP -1
```

The 'step -1' tells the machine to count backwards. You don't need the semicolon since the 'step' function is not a separate command but part of the command being used. While we're at it, 'step' can tell the machine to count by 2s, 3s or whatever either backwards or forwards. For example, change line 10 in the program to:

```
10 FOR N=121 TO 60 STEP -7
```

This will give you an ascending sequence of 9 tones. To get ascending and descending tones, try:

```
10 FOR N=121 TO 60 STEP -7
20 SOUND 0,N,10,8
30 FOR W=1 TO 100:NEXT W
40 NEXT N
50 FOR N=60 TO 121 STEP 7
60 SOUND 0,N,10,8
70 FOR W=1 TO 100:NEXT W
80 NEXT N
90 GOTO 10
```

When there is a particular operation that the machine is to perform in exactly the same manner at several different places in the program, you can use a subroutine. A 'gosub' tells the computer to leave temporarily the main program and go to a subroutine. In the subroutine, a 'return' tells the computer to continue with the main program at the line following 'gosub'. So we can rewrite the previous program using a subroutine:

```
10 FOR N=121 TO 60 STEP -7
20 GOSUB 500
30 NEXT N
40 FOR N=60 TO 121 STEP 7
50 GOSUB 500
60 NEXT N
70 GOTO 10
500 SOUND 0,N,10,8
510 FOR W=1 TO 50:NEXT W
520 RETURN
```

The difference between these two programs may seem to be a matter of six of one and half a dozen of the other. But it can be a very useful programming tool.

In order to turn on more than one voice, make a 'sound' statement for each. For example, the following program will make the machine play the three notes of a C major chord (C-E-G) all at once.

```
10 SOUND 0,121,10,8
20 SOUND 1,96,10,8
30 SOUND 2,81,10,8
40 FOR W=1 TO 100:NEXT W
50 END
```

If you wish to change to different chords without having to type in 'sound' for each new one, change the above program into a subroutine. Make the note values be the variable N and change the line numbers so that it appears at the end of the program.

By entering different values for N and going to the subroutine, you can easily change chords. Here's a program that plays a C major chord but switches back and forth between two different octaves:

```
10 N0=121:N1=96:N2=60
20 GOSUB 500
30 N0=243:N1=193:N2=162
40 GOSUB 500
50 GOTO 10
500 SOUND 0,N0,10,8
510 SOUND 1,N1,10,8
520 SOUND 2,N2,10,8
530 FOR W=1 TO 100:NEXT W
540 RETURN
```

Played in this way, the two chords are heard immediately after each other so that they run together with no pause. If you wish to create a slight pause, add a few lines to the subroutine that will turn the voices off briefly.

Move 'return' to line 580 and add:

```
540 SOUND 0,0,0,0
550 SOUND 1,0,0,0
560 SOUND 2,0,0,0
570 FOR Z=1 TO 10:NEXT Z
580 RETURN
```

Lines 540 through 570 tell the machine to turn off the three voices being used very briefly while it counts to 10 before returning to the main program. This brief pause between the chords is what you would expect to hear from more "conventional" instruments like the piano, for example. That is, you would be able to hear the beginning of each new note or chord as it is played. The way a note begins is called the *attack*. A violin or cello cannot create passages with the percussive attack of a piano. (Later articles will discuss ways in which the attack of a note can be varied.)

Looking at the program so far, by substituting different values for the variables N0, N1, and N2 in lines 10 and 30, it is possible to play various chords. Or by adding more lines, you can play more chords by still using the subroutine. For example:

```
50 N0=162:N1=128:N2=108
60 GOSUB 500
70 GOTO 10
```

would add a G major chord to the sequence.

Before going on, there is one more detail that can be added to the program: rather than have the time

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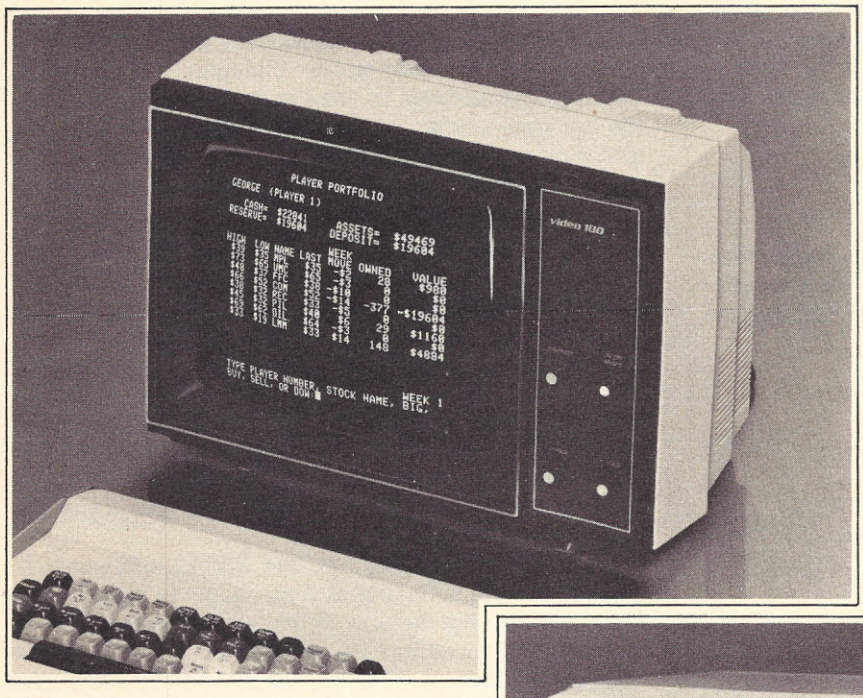

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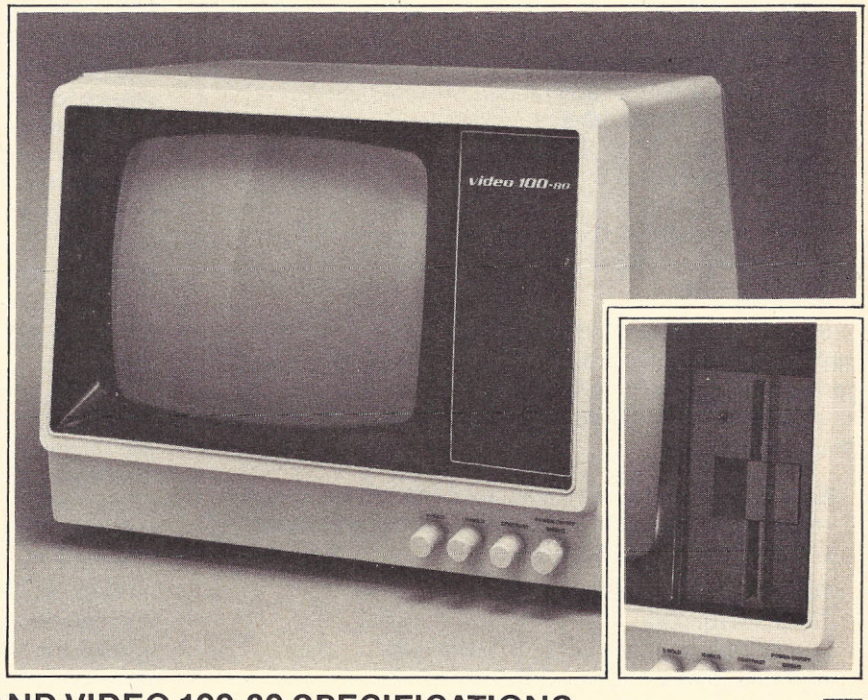

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CIRCLE INQUIRY NO. 3

delay loops found in lines 530 and 570 be of fixed duration, make them variable. Change lines 530 and 570 of the subroutine to:

```
530 FOR W = 1 TO X:NEXT X
```

and

```
570 FOR Z = 1 TO Y:NEXT Y
```

By giving different values for X and Y in the main program, the duration of the chords or the pauses can be varied. We simply need to add values after the values for the notes of the chord and before going to the subroutine. Try these to get the hang of it.

```
15 X = 100:Y = 10
35 X = 300:Y = 100
45 X = 50:Y = 250
```

Now you should have a program that looks like this. You may, of course, have some different values for notes and duration, but the basic form should be the same.

```
10 N0 = 121:N1 = 96:N2 = 81
15 X = 100:Y = 10
20 GOSUB 500
30 N0 = 243:N1 = 193:N2 = 162
35 X = 300:Y = 100
40 GOSUB 500
50 N0 = 162:N1 = 128:N2 = 108
55 X = 50:Y = 250
60 GOSUB500
70 GOTO 10
500 SOUND 0,N0,10,8
510 SOUND 1,N1,10,8
520 SOUND 2,N2,10,8
530 FOR W = 1 TO X:NEXT W
540 SOUND 0,0,0,0
550 SOUND 1,0,0,0
560 SOUND 2,0,0,0
570 FOR Z = 1 TO Y: NEXT Z
580 RETURN
```

So far the program has been playing only three of the four available voices at a time. It is fairly easy to introduce the fourth voice in such a way that it is able to play melodies against the background of chords already provided.

Here's a program that switches between the chords C major and G major with three voices and plays a melody with the fourth voice:

```
10 N0 = 121:N1 = 96:N2 = 81
20 GOSUB 500
30 N3 = 29:X = 15:Y = 10:GOSUB 540
40 N3 = 35:X = 15:Y = 10:GOSUB 540
50 N3 = 45:X = 15:Y = 10:GOSUB 540
60 N3 = 29:X = 15:Y = 10:GOSUB 540
70 Y = 10:GOSUB 570
80 N0 = 243:N1 = 193:N2 = 162
90 GOSUB 500
100 N3 = 72:X = 40:Y = 10:GOSUB 540
110 N3 = 81:X = 40:Y = 10:GOSUB 540
120 Y = 10:GOSUB 570
130 GOTO 10
500 SOUND 0,N0,10,8
510 SOUND 1,N1,10,8
520 SOUND 2,N2,10,8
530 RETURN
540 SOUND 3,N3,10,8
550 FOR W = 1 TO X:NEXT W:GOSUB 600
560 RETURN
570 SOUND 0,0,0,0
580 SOUND 1,0,0,0
590 SOUND 2,0,0,0
600 SOUND 3,0,0,0
610 FOR Z = 1 TO Y: NEXT Z
620 RETURN
```

This program is built in essentially the same form as the previous one with a few changes and additions. There is the addition of lines in the subroutine to turn the "melody voice" on and off. These are line 540 to turn it on and line 600 to turn it off. The use of the time delay sequences in the previous programs (lines 15, 35, and 55) has been eliminated.

If these lines are left in, the machine would play the chord for the designated duration and then turn it off before executing the lines that play the melody sequence. In order to keep the voices of the chord on, and the melody playing simultaneously, take advantage of the fact that any voice will remain on a particular note until we either turn it off or change the note. Therefore, after registering the note values for the three voices of the chord (line 10), the program goes directly to the subroutine in line 500 and turns the voices on.

The 'return' statement at line 530 is necessary to get back to the main program and begin to execute the lines that play the melody. In this way we get out of the subroutine without turning off the voices of the chord.

Line 30 enters a note value for the melody voice, and values for the duration of each note and the pause after it. 'Gosub 540' tells the machine to execute lines 540 and 550, which turn on the melody voice for the duration indicated by the value of X in line 30. The 'gosub 600' at the end of line 550 tells the machine to skip down to line 600, which turns the note for the melody off for the length of time indicated by the value of Y in line 30. The 'return' statement in line 620 tells the machine to go back and pick up where it was, in this case right after line 550.

But we need to get out of the subroutine at this point and play the next note without turning off the voices of the chord. The 'return' statement at line 560 sends the machine back to line 40, which executes the same sequence just described but with a different value for N3. Line 50 does the same.

At line 70, we want to turn off the voices of the chord as well as the melody, so we go to line 570 of the subroutine. Lines 570 through 610 will turn off all four voices for the duration entered for Y in line 70; 620 returns to the main program at line 80.

Lines 80 through 120 repeat the same process as lines 10 through 70 in order to play a different chord and melody notes.

In this form, enter whatever values you want for notes, their duration and the pause after them in such a way that the three notes can be sustained while another voice moves independently. Start the subroutine at line 5000 to allow more room, then enter numerous sequences of sustained three-note triads with melodies.

Next month we will discuss color graphics, which can be programmed in Atari Basic, and explain how to coordinate them with sound. □

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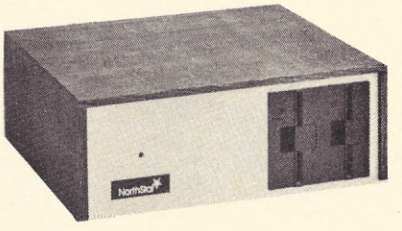

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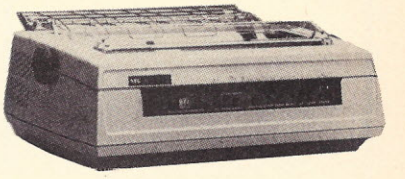

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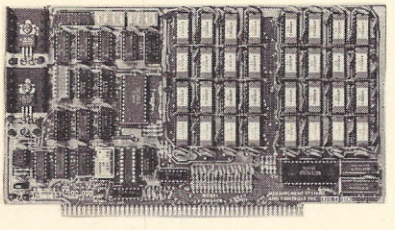

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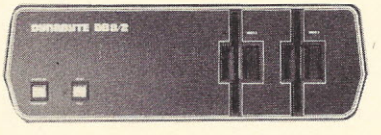

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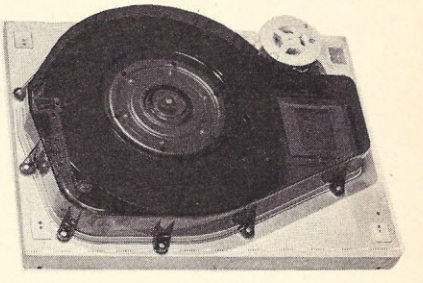

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Assignment: Benchmark

Texas Instruments 771

Vendor Support is a Critical Factor

	C-3 Accounts Receivable Time	Current Price
Texas Instruments Model 771	3:38.1	$12,100
North Star Horizon	1:57.7	$ 6,911
Cromemco System Two	2:48.0	$ 9,275
Vector Graphic System B		
DECstation 78		
Pertec PCC 2000	*to be covered in future issues*	
Radio Shack TRS-80 Model II		
Apple II Plus		
Digital Micro Systems DSC-2		

by Hillel Segal

In the field of computers, more so than with most products, the importance of a good relationship between dealer and customer cannot be over-emphasized. Communication and assistance should begin before the sale and continue long after the equipment is delivered. When the vendor provides the required help quickly and efficiently, a new computer installation is practically assured of success; if assistance is slow in coming or ineffective, the advantages of automation can turn into the causes of distress.

This reminder is especially important in the case of the Texas Instruments 771. Not because there is anything wrong with TI—that firm's reputation is fine within the business community—but because the model 771 is sold almost entirely through independent OEM outlets. The customer often relies entirely on the vendor for all programming aid and maintains no in-house staff for that purpose. When problems arise, there is only one place to turn: to the dealer. The hardware manufacturer won't help, since it didn't write the program and is not in the software business.

The quality of vendor support is one of those intangibles every customer should weigh carefully before selecting a particular computer system. We can't measure such an element in our benchmark tests, but we don't ignore it either. Each report on a system includes a portion devoted to the results of a survey of users. While the survey sample is much too small to provide a scientifically accurate representation—a dozen or so users— the responses are remarkably candid and provide a glimpse at promises and problems that come with each purchase.

Of course, the heart of the benchmark reports is the series of speed tests that enable us to rank computers according to performance. The tests are conducted by an independent consulting firm and are based on standard programs written in Basic. Due to variations in

language standards from machine to machine, the programs must be slightly modified to run on each system. In cases where Basic is not offered, the program is translated into a language suitable for that computer.

The benchmark tests fall into three categories—two speed tests and an ease-of-use test of the program editor that's incorporated into the language. The speed tests include a check of arithmetic calculation efficiency, a test of diskette read and write functions and a group of real-life problems designed to simulate programs used in everyday operation.

Of the real-life tests (three in all), we have chosen to report on the accounts receivable problem for the purposes of this series. It involves updating a set of records that simulate a hypothetical company's billing system. A diskette file containing 50 records of customer accounts is set up; each record has 10 information fields within it, holding data such as customer number, salesman, year-to-date sales, month-by-month sales for the past five months, payments and credit limit.

As the program runs, sales and payment amounts are updated ten times for each record, according to the customer number. When the program is finished, a report is displayed on the CRT screen that details the current status of the accounts. The same problem is also run with output to the printer instead of the screen, giving a check of how printer speed affects overall performance. Our scorebox, however, shows the times based on screen output.

This month's system ran the accounts receivable problem in 3 minutes, 38.1 seconds, a respectable time that is a bit faster than average for those computers tested so far. All computers in the group are priced under $15,000 for a complete configuration including two diskette drives and a printer.

The 771's performance in other benchmark tests was generally about average or a little better, with one notable exception. In the ease-of-use test, it gave an outstanding run, leading all systems tested so far. Ironically, since most users don't program this system themselves, the efficiency of the program editor is of little consequence to them.

Other languages available

Basic is not the only language offered for the 771. In fact, it's not even the most widely used language. Instead, that distinction falls to a language called TPL (terminal programming language). TPL contains a forms fill-in feature that makes it easier to program for applications involving a fill-in-the-blanks task. The TPL editor was also checked for ease of use, and it did even better than the Basic editor.

The popularity of TPL with the vendors who create software provides one clue to the type of application where the 771 is most widely used. A second clue comes from the original name given to the system: intelligent terminal. Nowadays, TI refers to the system as a small business computer, a designation more in line with its capabilities. Most people now think of intelligent terminals simply as more sophisticated variants of the CRT/keyboard combination. Such devices generally lack disk storage or extensive programming capability; the 771 has both.

Specialized communications features lend support to use of the 771 in an environment including bigger systems than itself, bringing back the notion of its use as a terminal. It includes IBM 3780 emulation for communication to a large host computer among its standard protocols.

For use as a stand-alone computer, one drawback should be noted: memory capacity available to the user. The system has a maximum total memory of 64K bytes, but most of this is taken up by the Basic language and operating system. During program development, less than 18K is accessible to the user; in run-only mode, slightly less than 22K can be utilized. These limitations forced some tricky programming during the benchmark testing in order to squeeze large arrays into the available space.

Standard features included

The complete model as tested included two disk drives, holding 256K bytes of data each, a 150 cps line printer, the CRT/keyboard, and Basic along with the operating system. The price tag for this configuration was $12,100; it could be lowered by substituting a slower thermal printer built-in to the CRT/keyboard housing, instead of the external line printer.

Graphics capabilities are standard for the system, and the CRT displays a 24 by 80 character page. The keyboard contains a numeric key pad and 32 special function keys as well as the usual typewriter and cursor control keys.

The Basic implementation included automatic file-handling for the disk, debugging aids such as breakpoints and tracing and some statements useful for structured programming. Another feature is protection of programs and files from unauthorized use. One drawback of the language was lack of a simple way to change a program from screen to printer output. Instead of changing a single command to redirect the output, it was necessary to alter each 'print' statement individually within the program.

TI has always had a strong reputation for hardware reliability, and the 771 is no exception in that regard. But in the area of vendor support, the end users contacted gave mixed reviews to the dealers they had purchased from. While one told us, "Our dealer has been great," another complained of a "communication gap" that hindered development of needed software. A third said lack of training and documentation for the tasks the system would perform had given him a "tough time."

Complaints about documentation and training run rife throughout the computer industry, so TI's OEMs may not be atypical. But the selection of a dealer is a choice no less important than that of the computer equipment itself. □

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several other foreign countries.

One of the association's key activities is the publication of its "Benchmark Reports." Each month a new report is produced covering another computer system.

In addition, ACU publishes seven bimonthly newsletters for users of small computers, midi computers, large computers, time-sharing systems, distributed processing systems, word processing systems and home and hobbyist computers.

Complete information about membership in the ACU is available at P.O. Box 9003, Boulder, CO 80301.

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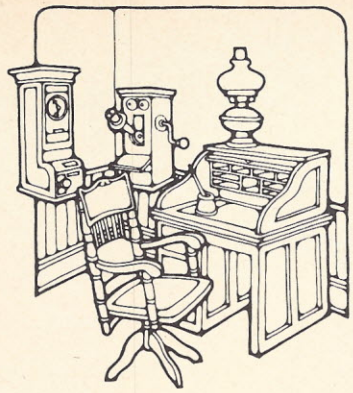

Articles Wanted...

INTERFACE AGE is seeking a variety of business-related articles for the August issue. Among topics to be included are packaged software, turnkey systems, and maintenance contracts, as well as reviews of business software. Articles intended for the August issue should be received no later than April 15 for consideration.

Other subjects being sought for 1981 include: business hardware, software, and unique applications, computer languages, medical, educational and home applications, peripherals and interfacing products, tutorials and word processors.

The payment rate ranges from $20 to $50 per published page. Pieces describing company projects or products will carry the company byline, but no payment is offered. Submittals should include an abstract, outline and stamped return envelope.

Manuscripts should be typed, double spaced with one-inch margins. Minimum length is four pages, unless programs are included. Photos should be numbered and have a brief description attached. Tables, listings, etc. should be on separate pages and each should have a caption. Computer listings should be printed using a new ribbon to assure good reproduction. Authors are requested to submit a statement of their background and expertise.

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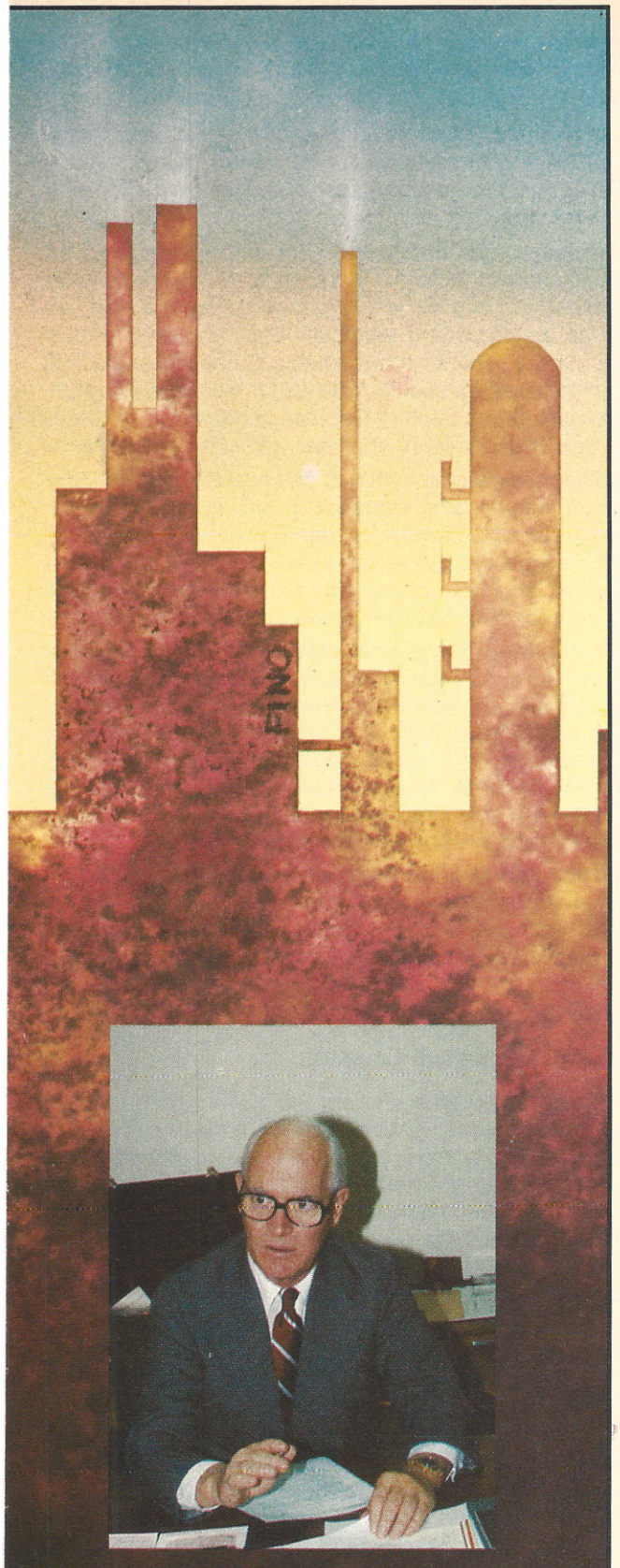
Tymshare's Andresen: "...a wealth of in-place expertise that can be brought to bear on a client problem."

National CSS's Arnold: "We equate time with money... help an executive make the most profitable decision in the quickest time."

...and McCrory: "If a job be done on an Apple II, tha where it should be done."

SHARE IT, LEASE IT, BUY IT, ...OR FORGET IT

by Michael Panchak



Cado's Ryan: "You can buy a small computer today for about $15,000. Even at today's interest rates, that's about $2.50 an hour."

While computer technology is reaching levels of sophistication that mind-boggle even its inventors, the average John Q businessman is still uncertain about how to computerize his operations...and even less sure of what to expect after he does. Essentially he has three methods from which to choose: time sharing, equipment leasing or outright purchase.

To explain how each method works, what it offers a user, some idea of the costs involved, and which approach is best suited to which user, IA had several top computerists in each field tell their side.

Cherie Andresen, branch manager for Tymshare in Los Angeles, describes a typical user, why he resorts to time sharing, and what special adaptations her firm offers:

"There are a number of reasons someone comes to an outside vendor as opposed to purchasing or leasing an in-house system. A firm may already have a complete and very efficient data processing staff that can develop any particular system it wants—let's say cash forecasting or financial analysis. But they have other priorities—day-to-day bread-and-butter transactions: general ledger, fixed assets.

"So what we term analysis-type systems are further down the list. The MIS director says, 'sure I can do that for you. It will probably take six months to a year.' This happens very, very frequently. So they go to an outside service.

"Another reason to time share is when confronted with an overload on the in-house computer. A firm may have very large computers but the top priorities are day-to-day transactions, and they take up the room.

"Or we may have a piece of software or tool particularly applicable to a problem. They come to us to put together a system using that tool.

"However the strongest reason is our expertise. One firm simply does not have a group of programmers who know as much as we know about financial systems... marketing systems...personnel systems. We do it all the time...for a living.

"We offer a full service...somebody they can turn to when they need terminals, consulting, systems work, someone to help with development...whatever. They know we can provide them with everything.

"Our clients are the large corporations—Fortune 1000—covering all industries; petroleum, financial, aerospace. We work closely with MIS departments in the large firms because they have the data that is going to be taken off of tape and put into our system. Or we may share programmers assigned to develop a time-share system.

"This is a sophisticated operation—not for mom and pop clothier down the street. Even though that's pretty much the way they began...small companies that didn't have computers, didn't have the money to invest in a computer or didn't know anything about it.

Geared for top-level planners

"Now we deal with top-level management: say a VP of finance or his analysts; or the director of planning. They are the personnel that have the problems that we have the solutions for.

"Most times they are not dp-oriented personnel. That's why our tools are designed for people who don't know anything about using computers.

Sound expensive? "Only if you take a very superficial look. It would appear that an outside vendor is more expensive (than an in-house system) because each month you're writing a check for services and mailing it to another firm.

"But one has to look at the total picture. There are a lot of value-added elements wrapped up in the time-share service: expertise, support a phone call away. All is brought to bear on a customer's particular problem.

"With an in-house computer, you have some software that you've bought, and your programmers. If you have employee turnover, you lose the guy who was running your system. The cost for people is astronomical. And it is very tough keeping good data processing people. That is very, very expensive.

"With time sharing, you have this wealth of in-place expertise that can be brought to bear as part of the package. In real dollars and cents in the total picture, the outside solution isn't nearly as expensive.

How much? "Well, we're not talking in the hundreds. Our systems are used by top-level management to drive a company. We're not selling little general ledger programs...but a capability system that enables a VP of finance in a major corporation to make a decision on acquiring another company, or getting large-scale outside financing.

"Software isn't customized. We have no packages. We consult with a VP of finance, find out what he does, what decisions he has to make, how he makes them, what kinds of information he needs. Then we design a system for him from scratch.

"We provide him with the capability to talk to his data, get supporting evidence: what happens if I do it this way as opposed to that way. If a VP of finance makes the right decision, saving the company a half-million dollars, a bill of $200,000 is more than worth it.

"Our people cost us some bucks because they are top-level. My staff is full of MBAs, people with a lot of experience, and we have top-of-the-line equipment.

"One perceived disadvantage, however, is that a time-sharing company will develop a software system that is proprietary to them. The client claims that it locks them in to that time-sharing company. The bills get higher and higher and they are trapped with a piece of software unavailable elsewhere.

"We have resolved this problem—and I think other companies have too. Our tools can now be purchased by a customer and moved in-house. So they are not locked in to a time-sharing company.

"I would like to make very clear that that is not the business we are in...selling software systems and moving them in-house. But if that's the sort of solution a problem requires, it's certainly a viable alternative."

John Arnold, Southwest district manager and Diane McCrory, branch manager for National CSS Inc., explain exactly how time sharing serves one of their clients: a large LA hospital.

"It uses us as a data base for all physicians on its staff," explains Arnold. "It keeps track of educational certifications that the doctors take during the year, as well as medicaid and medicare reporting and various government reports. It becomes a multipurpose tool. It can print labels for special mailings for meetings with staff physicians; keep track of who has had emergency duty. We help it do problem analysis, and offer solutions.

"The medical staff office of this hospital was keeping various manual filing systems: a card index system to keep track of emergency room service, a file system for personnel data, emergency room service, personnel records...and continuing education information. And still another filing system that kept track of other data.

"What they found was that whenever they were audited by any of the federal or state agencies, all the information was stored in different places. To prepare for one of these special meetings or to prepare an annual report, they would have to manually go through all these records. Now it's consolidated on one data base. When changes and updates are needed, they can be made directly into the data base.

"They can request things like 'give me a list of all staff physicians who have taken continuing education in the past year.' They can pull out special reports because the data base has a report writer English. We are keeping track of 1000 physicians and all their medical activities.

Helping the decision makers

Basically, the time sharers are selling productivity. As Arnold points out: "We equate time with money. An executive flying from LA to NY for a meeting has several ways to get there. He can take a jet...a train... drive a car...even hitchhike. Any of these ways will get him there. What we're selling is that we will get him there the quickest. Time is money and he's going to make the most profitable decision for his company that much quicker.

Like the other large time sharers, CSS is not interested in small applications. "We have over 100 nitty-gritty technical experts," McCrory adds. "If a job can be done on an Apple II, that's where is should be done. It would probably be a lot more expensive doing it with us. We don't compete with the Apple II."

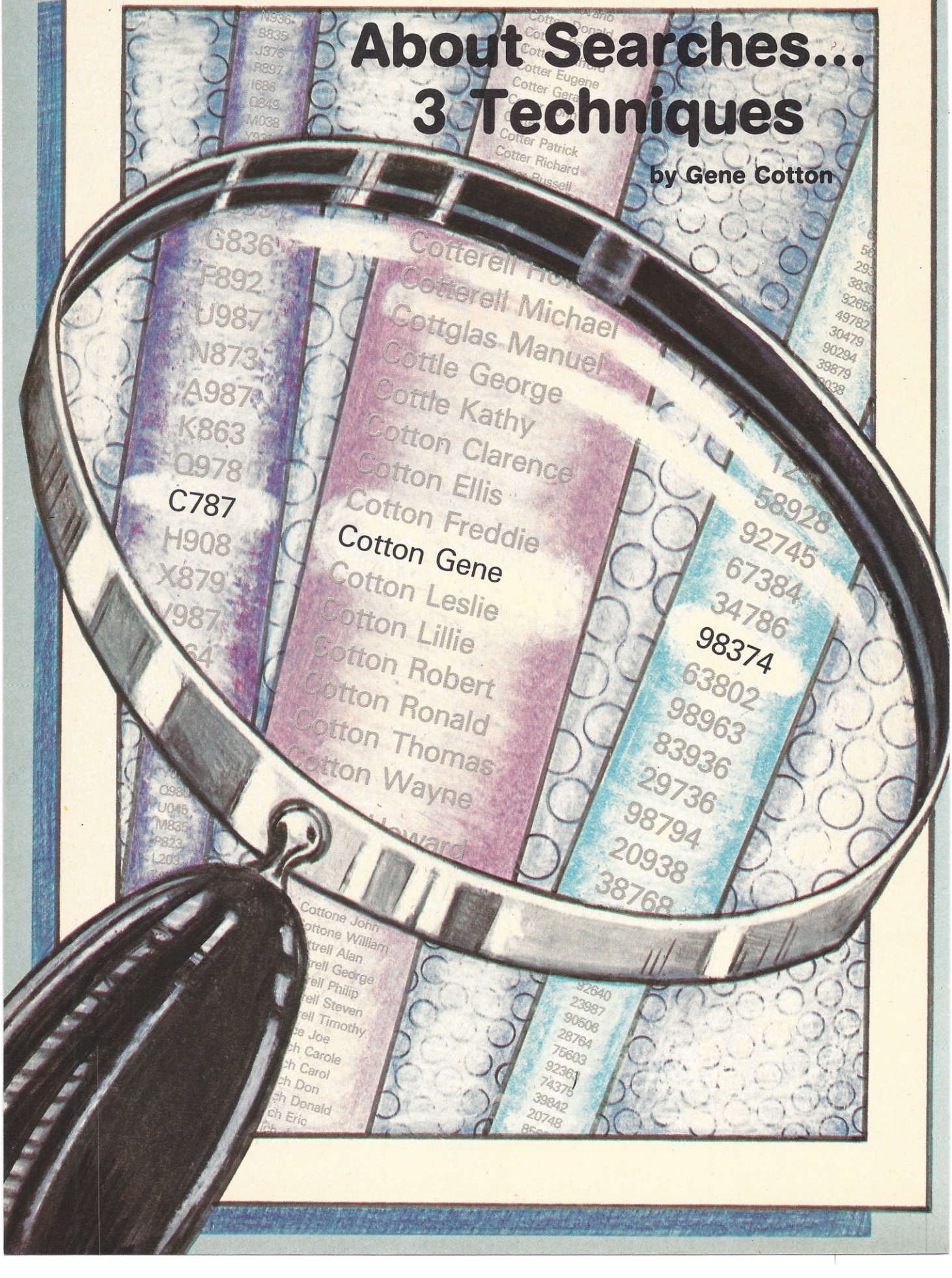
Vince Littlefield, marketing director for Terminal Systems, in North Hollywood, CA, leases equipment. And besides the Fortune 1000, his operation *is* for the Ma and Pa Kettle-type business which may just need a VISA-checking system. Right off the bat, he clicks off three chief advantages to leasing:

"Many of the big companies prefer to rent. They don't need the tax write off; use it as a cost of doing business and charge it off for the year. Secondly: If you rent, part of the agreement is for the rental firm to

Continued on page 152

About Searches... 3 Techniques

by Gene Cotton



The capability to "look things up" in tables or lists of data is a task that everyone faces at one time or another. It is not uncommon to have two related lists of information, with one list serving as the searched list and the associated entry of the other list as the information sought.

The requirement for such a task can be demonstrated by considering a list of salesmen, their numbers, and their commission rate.

43	A. Adams	.025
21	B. Burns	.020
18	C. Calks	.035
25	D. Draft	.030
30	E. Eston	.015
12	Z. Zerby	.025

The salesman's number is placed on each sales order. As the sales orders are read, the number is looked up in the list. The name and rate of commission are found by reading across to the other lists.

There are two aspects to searching: First the "attempt to find;" second the using of the "found." During the search, the sequence of known data is important, and only during the use of the found entries is other data important.

The searching process is based on the field of information that is known, for example the salesman's number. The presence of any other field or fields is less important. The elements are identified by their relative position in the list (1st, 2nd, 3rd, etc.) If the seventh salesman's number is the one sought, the seventh commission is the one needed. A number associated with a relative position in a list is called the index of the entry.

Since it does not matter if the search list is numeric or string, it seems justified to concentrate on integer lists and arguments. The techniques will be appropriate in either case.

The easiest arrangement of elements is an array with subscript range 1 to 'nent', where 'nent' represents the number of elements in the list.

In Pascal, this could be represented as:

```
CONST NENT = 26;

VAR   SALESMAN   : ARRAY [1..NENT] OF INTEGER;
      COMMISSION : ARRAY [1..NENT] OF REAL;
      ARGUMENT, INDEX : INTEGER;
```

It will be assumed that 'salesman' and 'commission' will contain the previously mentioned lists of salesmen. How the information gets into the lists is not important at this point.

Consider the task of looking for a particular piece of paper in a stack of papers. The top piece of paper is picked up, checked to see if it is the one wanted, and set aside if not. The second piece of paper, now on top, is picked up, checked, and put aside if it is not the paper looked for. The process continues until the paper is found, or no more paper is in the stack. This process of sequentially retrieving elements of the list until a find or until the list is exhausted is called a sequential exhaustive search.

Apply this method to the problem of the salesmen's number and their rates of commission.

The incoming sales order (denoted as 'argument') is compared to each of the elements of 'salesman' by setting 'index' to 1 and incrementing the index by 1 until a match is found:

```
FOR INDEX := 1 TO NENT DO
  IF ARGUMENT = SALESMAN [INDEX] THEN
    (* do something with COMMISSION [INDEX] *)
```

The drawback is that it continues through the entire list no matter where the match occurs. In the case of A. Adams, this is 'nent — 1' too many times. An improvement might be:

```
INDEX := 1;
REPEAT
  IF ARGUMENT = SALESMAN [INDEX] THEN
    (* do something with COMMISSION [INDEX] *)
  ELSE
    INDEX := INDEX + 1
UNTIL (INDEX > NENT) OR
  (ARGUMENT = SALESMAN [INDEX]);
```

This will insure that the loop is terminated when a match occurs at the expense of breaking out the components of the 'for' loop.

The number of times the argument is compared against the list can be halved by separating the functions of finding and using:

```
INDEX := 0;
REPEAT
  INDEX := INDEX + 1
UNTIL (INDEX > NENT) OR
  (ARGUMENT = SALESMAN [INDEX]);
IF ARGUMENT = SALESMAN [INDEX] THEN
  (* do something with COMMISSION [INDEX] *)
```

This works fine as long as the argument is always found in the list. It is safer to change the find/no-find decision:

```
INDEX := 0;
REPEAT
  INDEX := INDEX + 1
UNTIL (INDEX > NENT) OR
  (ARGUMENT = SALESMAN [INDEX]);
IF INDEX <= NENT THEN
  (* do something with COMMISSION [INDEX] *)
```

The only time 'index' is greater than 'nent' is when no match was found between 'argument' and 'salesman' ['index'].

A different but equivalent form would be:

```
INDEX := 1;
WHILE (INDEX <= NENT) AND
  (ARGUMENT <> SALESMAN [INDEX]) DO
    INDEX := INDEX + 1;
IF INDEX <= NENT THEN
  (* do something with COMMISSION [INDEX] *)
```

Each time through the loop, two comparisons must be made: one to check for the match of the argument, and one to check for the end of the list.

It is possible to eliminate the check for the end of the list by making sure that the argument is always found. In order to make such a guarantee, the argument is placed in the list. Since all of the elements in the range '[1..nent]' are occupied, one extra element has to be added to the range. The extra entry could be at the beginning or the end of the list. Although the choice is arbitrary, if the list grows and shrinks, the easiest choice is at the beginning.

The array declaration must be changed to:

```
VAR SALESMAN   : ARRAY [0..NENT] OF INTEGER;
    COMMISSION : ARRAY [0...NENT] OF REAL;
```

Where the elements '1..nent' contain the same information as before but a new element 'salesman[0]' is available.

The technique is to place the argument in the 0 element and check the list from back to front. If the element is found in the range '[1..nent]', it is a true find. If the element is found at 'salesman[0]', it is a false find (i.e., not found).

The final version of the routine is:

```
(* Sequential Exhaustive Search Routine *)
SALESMAN [0] : = ARGUMENT;
INDEX : = NENT;
WHILE ARGUMENT < SALESMAN [INDEX] DO
  INDEX : = INDEX - 1;
IF INDEX > 0 THEN
  (* do something with COMMISSION [INDEX] *)
```

It is easy to predict how many times the loop will be executed when the argument is not in the list. If the array contains 'nent' elements, the loop is executed 'nent' times for a no-find. For an array of 100 elements, 100 tries before a not-found condition is established.

The task is not so easy when the argument is found in the array. In order to predict how many tries (number of times through the loop), it is necessary to predict what elements will be looked for.

Lists can be of two basic types:

(1) each element is equally likely to be searched for
(2) some elements are more likely than others to be sought.

Consider type 2 momentarily. In our example array of salesmen, suppose that C. Calks accounts for 80% of sales orders. It would seem reasonable that Calks should be the first element in the list to be checked against any incoming sales orders. In general, the most likely element should be placed so that it is the element looked for first. The second element to be looked for should be the element looked at second. Continue the pairing until no more elements exist.

If the array elements are rearranged to fit the pattern, it is appropriate to say that 80% of the time a match occurs in one try. The analyses of each list of this type will depend on the probabilities of each element matching the search argument.

Unless some of the elements are disproportionately more often sought, the list can be assumed to be of type 1. The advantage is the ease of analysis.

Since each element is equally likely to be looked for, sometimes the find will occur in the first half of the list; at other times the find will occur in the last half of the list. Over a period of time, about as many arguments will be found in the first half of the list as are found in the second half. This will mean that "on average," a match will occur after 'nent / 2' tries. For an array of 100 elements, the average number of tries for a match is 50.

Because of the brevity of this method, it executes very fast. For relatively small array sizes (nent < 20), this is faster than the binary search method, which is based on the same principle as the guessing game Hi-Low. Person B is asked to choose a number between 1 and 100 (inclusive). Person A will guess the number in no more than seven tries. If A's guess is not the number, B must tell A if the guess is too high or too low.

The strategy is to guess the number in the middle of the range of numbers (50). If the guess is correct, the game is ended. If the guess is too low, a guess in the range 1 to 50 would be even lower. If the guess is too high, a guess in the range 50 to 100 would be even higher. In either event, half the original set of numbers can now be discarded. The next guess is over 49 (1 to 49 or 51 to 100).

The next choice is the mid-range of numbers (25 to 75). This guess is either correct and the game ends, or half of the remaining numbers is again eliminated. The number of possibilities is reduced from 100 to 50 to 25 to 13 to 7 to 4 to 2 to 1 in the worst case. This means that no more than seven tries are required to guess the number.

Because of the brevity of this method, it executes very fast.

There is one requirement of the list for this method to function properly. The list must be "in order" either numerically or alphabetically. The elements may be in either ascending or descending order. The criteria for an ordered list is based on the fact that if the search argument is less than the indexed element being checked, it is also less than any element whose index is bigger (for ascending order).

Assume that the elements of the example are rearranged to be in numeric sequence by salesman's number:

12	Z. Zerby	.025
18	C. Calks	.035
21	B. Burns	.020
25	D. Draft	.030
30	E. Eston	.015
43	A. Adams	.025

For convenience, require that the search routine return a 0 if not found and the number of the element that matches 'argument' if found.

This would be translated into Pascal as:

```
(* Binary Search function returns 0 if no find *)
FUNCTION BINARY_SEARCH(ARGUMENT:INTEGER)
  :INTEGER;
VAR LO, HI, MID : INTEGER;
BEGIN
  LO : = 1;
  HI : = NENT;
  REPEAT
    MID : = (LO + HI) DIV 2;
    IF ARGUMENT < SALESMAN [MID] THEN
        HI : = MID - 1
      ELSE
        LO : = MID + 1
  UNTIL (HI < LO) OR
    (ARGUMENT = SALESMAN [MID]);
  IF ARGUMENT = SALESMAN [MID] THEN
    BINARY_SEARCH : = MID
   ELSE
    BINARY_SEARCH : = 0
END;
```

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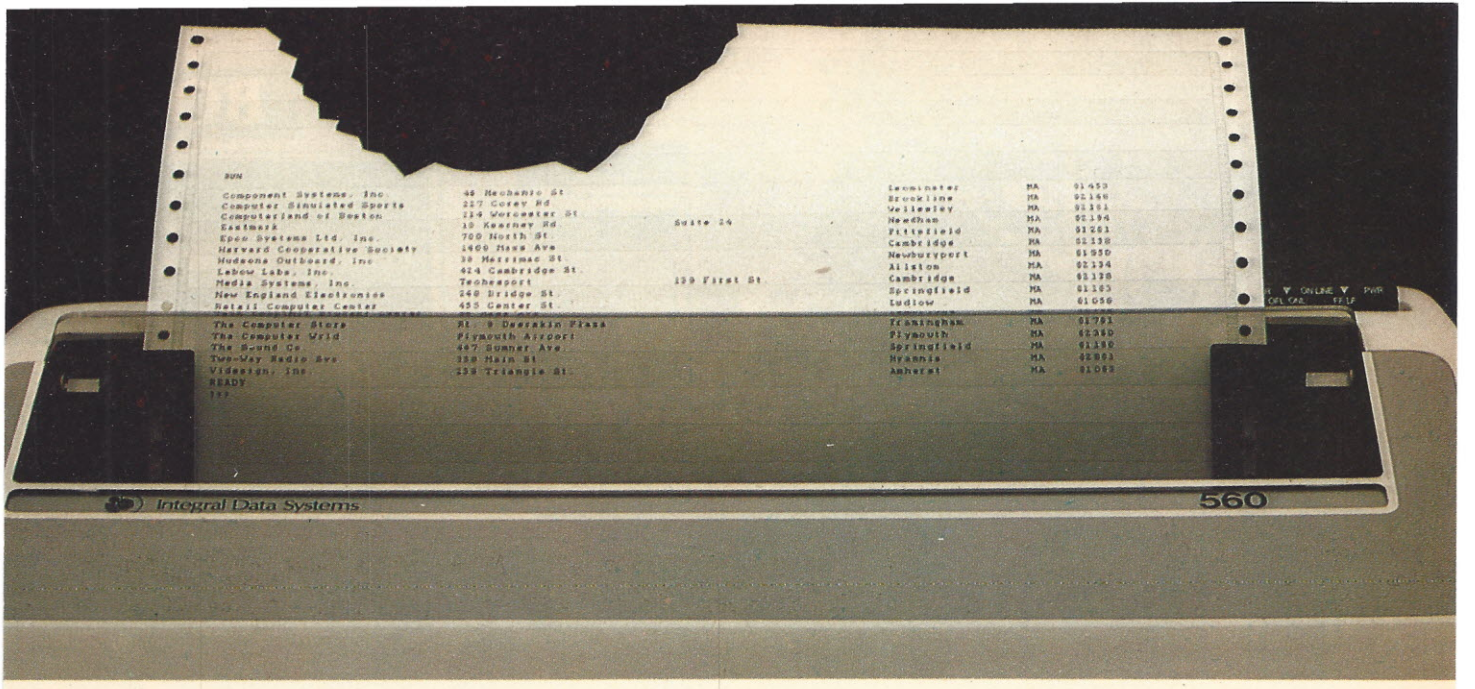

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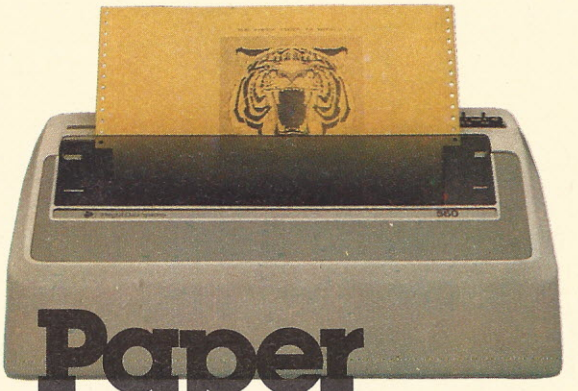

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BOOKS
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COMPUTERS BY MAIL

by Tom Fox

Buy a mail-order computer? Why not? Lots of things are purchased out of catalogs these days. If one shows up in your mailbox that just happens to show the very computer you almost decided to buy from your local dealer—at a substantially discounted price—why shouldn't you take advantage of it? Or would you be letting yourself in for more trouble than it's worth?

Here's our advice: If you know exactly what you are doing when purchasing a computer, and are

absolutely sure you won't need any assistance in assembling, checking out and operating the hardware and software, it is probably to your advantage to shop for the best price. Often, this can be found in mail-order catalogs. However, if you feel you need a little education it's best to stick with a local business for the initial buy—even at a premium price.

Retail computer dealers are far better equipped than catalog houses to give essential advice that is so important in learning about new devices. And this hand-holding isn't free; the dealer pays for it out of his profits. It isn't realistic to expect a knowledgeable computer person to help you get the best utilization out of a computer you purchased from the opposite side of the country.

This almost precludes the first-time purchaser from buying via mail order. There are exceptions, however. Some machines, particularly the simple, mass produced ones in the personal category, are so well designed and documented that willingness to learn is all you will need to get cooking.

If you're far from a metropolitan center and have your heart set on a computer with no local representation, you are forced to buy it by mail. We would counsel a good look at the brand name. Few machines have absolutely unique properties, and the chances are fair that another machine with similar capabilities could handle your tasks.

Once you own your machine, the catalogs begin to look more attractive. This is particularly true in the area of supply items such as paper and ribbons for the printer, typing elements (daisywheels or thimbles) for printers, floppy diskettes, tape cassettes and hard disk cartridges. These are usually brand name items, so it's hard to go wrong.

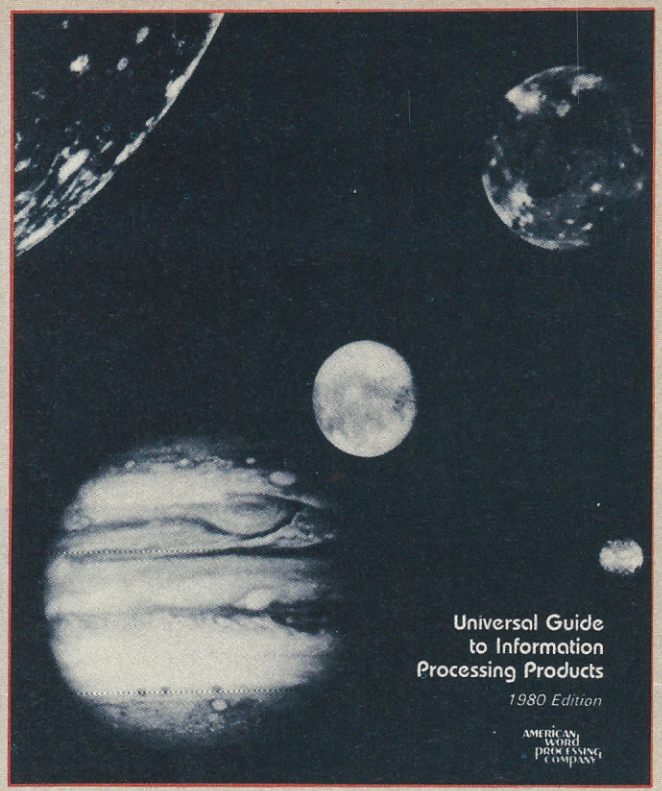
Purchasing a second printer or terminal is another mail-order possibility. This is also true of plug-in boards to enhance the memory size or other attributes of your machine. Connecting them up, however, often requires some knowledge of hardware and software; make sure you can handle it.

Warranty service is another area of difference. Some catalog houses have their own guarantees, and will accept the return of anything you buy from them. Others expect you to deal directly with the manufacturer. Computer equipment is remarkably trouble-free but there is still nothing as convenient as calling your local dealer if the lamp doesn't light when you turn on the machine one morning.

Here is a selection of computer equipment and supply catalogs that can usually be ordered via a toll-free call. We have selected those companies that deal with end users, and those that display a variety of brand names.

At 144 pages, the ***Advanced Computer Products*** book is the fattest of the catalogs we have found. This company began life as an electronic parts and surplus store in Southern California. With a heavy emphasis on electronic components and test equipment, the book also includes complete systems by Apple, Exidy, Pet, Atari, North Star, Cromemco and others. A good selection of S-100 plug-in computer boards is included.

American Word Processing is the first of our supply catalogs. It is a slick booklet containing paper, ribbons, daisy-type printwheels and other computer room products.



The ***Challenge*** catalog is similar but smaller. This company specializes in magnetic media, particularly floppy diskettes and hard disk cartridges by Memorex. Disk drive filters and unusual devices such as a temperature/humidity meter are also featured.

CompuMart's catalog shows a collection heavily laced with terminals and printers by Hazeltine, Lear Siegler and Centronics. It also contains computer systems by Apple and Commodore. Digital Equipment Corp. LSI-11 systems and software are also listed.

Computer supplies are the emphasis in the ***Devoke*** catalog. Printer ribbons, paper and floppy diskettes are shown, as well as a rich selection of document binders, trays and storage cabinets.

Electronic Systems advertises itself as a discount house and this premise is carried out in the competitive area of computer terminals (Soroc, Lear Siegler, Hazeltine) and printers (Qume, NEC, Centronics). Also shown are complete systems by ISC and Vector Graphic, several boards for the S-100 and SS-50 busses, and a generous listing of software for TRS-80 and Pet.

Minneapolis-based ***Fidelity*** has at least two catalogs; of interest to computer users is the one entitled *Data and Word Processing Products*. Listed are computer room supplies and accessories particularly filing and organizing devices and furniture.

The Los Angeles ***Hobbyworld*** computer stores are fun places to visit; but if that's not convenient, order the catalog. The emphasis is on recreational computing, with software games and all sorts of parts and plug-in boards to enhance the capabilities of your Apple or S-100 machine. Computers of Atari, Mattel and North Star are offered as well.

Inmac is the granddaddy of supply catalogs, and includes a well-rounded selection of consummable items for the computer room. This company handles enough volume to offer private label floppy diskettes and hard disk cartridges. A substantial portion of the

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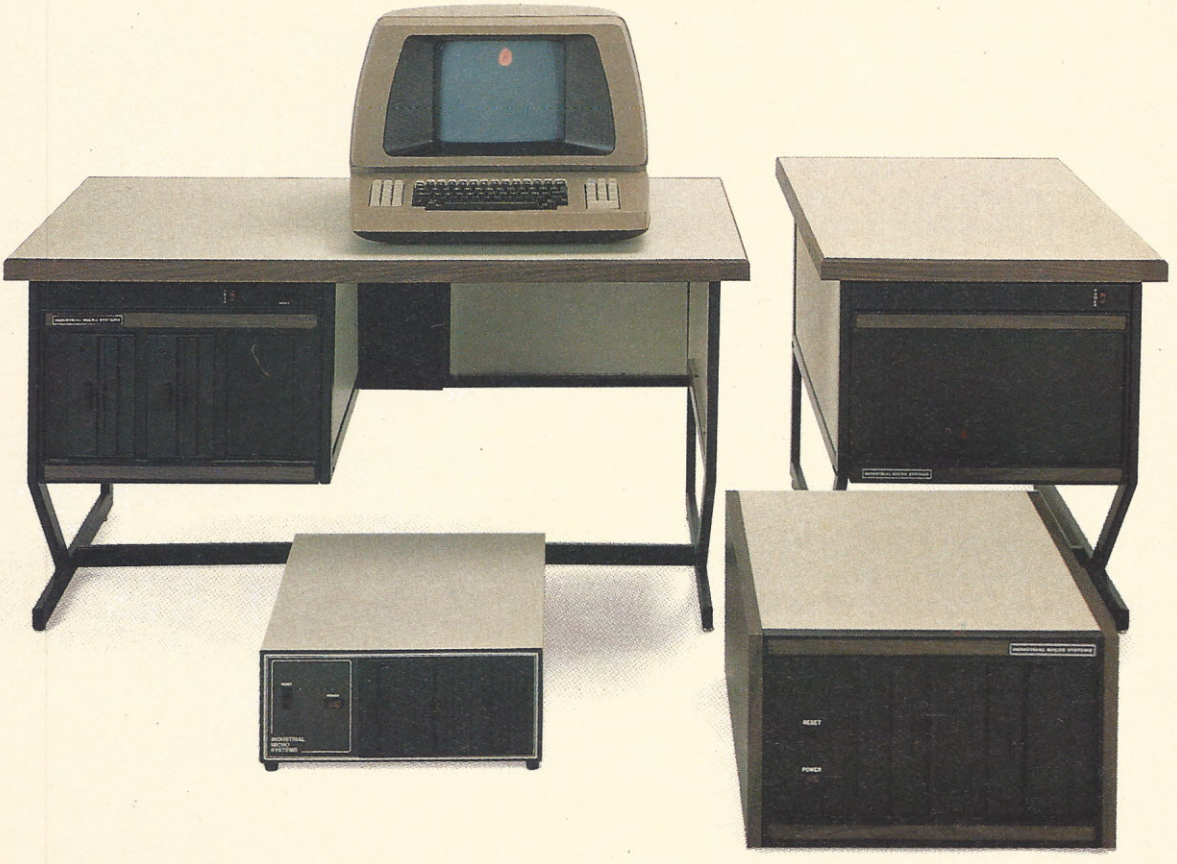

catalog includes an illustrated listing of cables to connect the various parts of a system together. Delivery from this company is as fast as you can get—but expect to pay list prices.

Jade is another LA-based electronic component store that has branched out into the mail-order business. Computer systems are shown for North Star, Vector Graphic, and some who we thought had gone out of business. S-100 boards abound, as do components and breadboards for wiring up your own electronic designs.

The slim ***Micromail*** catalog lists more than terminals and printers. Nearly a half-dozen brand names are featured in each category. Prices are as low as we have seen for these devices; some approaching dealer's cost. If you have an in-warranty failure, however, you must deal directly with the manufacturer.

The ***MiniMicroMart*** catalog is as entertaining to read as a circus poster. It's a compendium of reprinted catalog sheets from various manufacturers interspersed with breathless headlines by excitable copywriters. Computer systems are listed for most of the micro manufacturers you can think of, including Radio Shack. Pricing is uniformly low, and this is the only place we have seen that discounts the popular Word Star program. Watch out, though. The warning on the sales policy page should be read carefully: "Various pages in our catalog are printed and composed at different times...prices quoted may be inaccurate."

The ***Misco*** catalog is dedicated to supplies and computer room accessories. Verbatim and BASF magnetic media are featured.

Newman Computer Exchange is a mail-order clearing house for both new and used Digital Equipment Corp. computers and peripherals. The catalog contains several terminal and printer devices that will be of interest.

The jet black raven which adorns the cover of the ***E.D. Poe*** catalog introduces an unusual book. It is loose-leaf bound, and will probably be sent only if you are a serious, volume user of computer or word processing supplies. Floppy diskettes and media filing systems are listed, but the emphasis is on daisy printwheels, thimbles and printer ribbons. This book has the best collection of type style samples we have seen.

Priority One Electronics is heavily into electronic components and computer assemblies. The catalog also includes printers, terminals and modems. Test equipment and breadboarding supplies are also shown.

Uarco sells computer supplies and computer room furniture and media organizing accessories. Included is a good selection of printout binders and storage paraphernalia.

The ***Visible*** catalog is a thick one; it concentrates on computer supplies and consummables. Also included are furniture and preprinted continuous forms such as invoices and statements.

In addition to the catalogs, many individual manufacturers will be happy to serve you directly by mail. First in this category is Heath Co. (Benton Harbor, MI 49022), who sells both the kit and assembled versions of its line. Radio Shack (Fort Worth, TX 76102), although not strictly a mail-order house, has a new catalog RSC-4 that shows the complete range of its computer products. If you're into 6502 computing (Aim and Kim products), get the Micro Technology Unlimited catalog at P.O. Box 12106, Raleigh, NC 27605.

Should or shouldn't you order through a local dealer or mail-order catalog? The only way you can decide is to look at both ways of doing business in the computer world. That means visiting all the computer stores in your area and reading as many of these catalogs as interest you. We guarantee that browsing through a selection of these wish books will be an enjoyable and educational experience. □

Tom Fox can be reached at FoxWare Systems Corp., 17925-G Sky Park Circle, Irvine, CA 92714, (714) 957-9332.

Chart continued on page 81

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SHUGART – SIEMANS – CDC 8"				
+5V @ 1A	–5V @ .5A	+24V @ 1.5A	US-205	52.50
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+5V @ 3A	–5V @ .6A	+24V @ 5A	US-162	89.00
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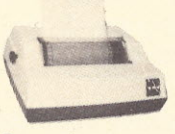
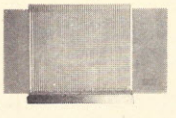


Look closely at the photo and see other adds in this rag at $995.00. Perfect units, warranteed. Only 500 pcs. Same story, manufacturerer had too many.

S-100 CARD EXTENDER

$12.50

(Gold Contacts)



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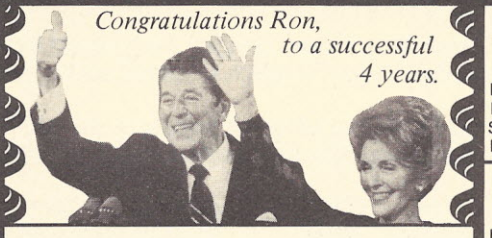

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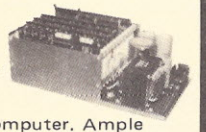

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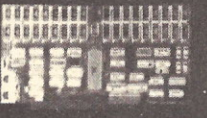

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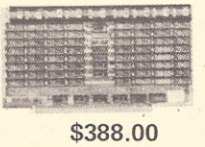

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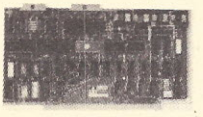

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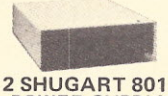

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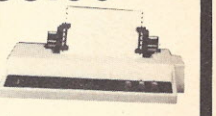

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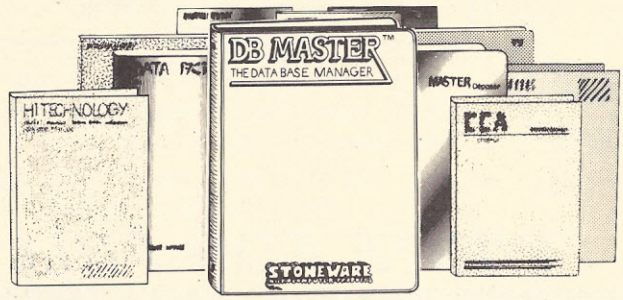

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True ISAM file system with multi-field primary keys	YES	_____
Multiple secondary keys for rapid access (5-7 seconds) to records by any field	YES	_____
Primary & Secondary keys maintained automatically—no need to rebuild keys after adding records	YES	_____
Maximum record size (bytes)	1020	_____
Maximum number of fields/record ..	100	_____
Handles files with more than one diskette of data	YES	_____
Custom disk operating system (DOS) for faster data retrieval and program chaining	YES	_____
User-designed screen formats	YES	_____
Up to 9 screen "pages" per record...	YES	_____
Ten field types, including dollar/cents, phone & social security number, date, etc.	YES	_____
Automatic data compaction for increased disk storage capacity.	YES	_____
Wild card, partial string, range and Boolean search capabilities...	YES	_____
Dynamic prompting (tm) - lists all available functions on screen—no need for quick reference card.	YES	_____
Password file protection	YES	_____
Four function calculator mode	YES	_____
Daily update lists for printout of all records added/edited on any day or range of dates	YES	_____
REPORT GENERATOR:		
Send reports to screen or printer....	YES	_____
Sort on up to 6 fields at a time	YES	_____
Column subtotals and totals	YES	_____
Subtotal and page breaks	YES	_____
Up to 24 computed fields per report .	YES	_____
Up to 9 lines of column titles	YES	_____
Up to 9 lines for each record	YES	_____
Maximum number of fields per report	100	_____
Code fields - store short codes, print long descriptions	YES	_____
Comment lines and footnotes	YES	_____
Comment fields for printing labels or headers within each record...	YES	_____
Summary only reports	YES	_____

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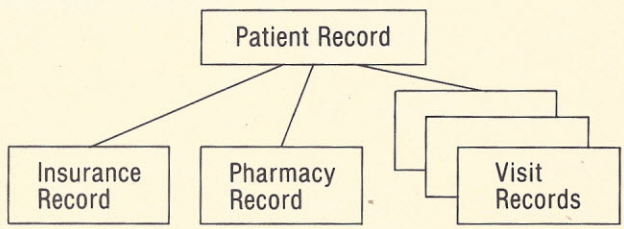

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CIRCLE INQUIRY NO. 70

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NAME and ADDRESS	TELEPHONE NUMBER(S)	LOCATIONS	GUARANTEE	MINIMUM ORDER	COST	PAGES	COMPUTERS	PERIPHERALS	ASSEMBLIES	COMPONENTS	ACCESSORIES	FURNITURE	SOFTWARE	SUPPLIES
Advanced Computer Products P.O. Box 17329 Irvine, CA 92713	(800) 854-8230 (714) 558-8813	CA	30 days	$5	$2	144	13%	17%	15%	18%	1%	1%	1%	1%
American Word Processing 18730 Oxnard Street Tarzana, CA 91356	(800) 423-5220 (213) 705-2245	CA	30 days	$25	Free	104	—	—	—	—	49%	9%	—	37%
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Devoke Data Products 3780 Fabian Way Palo Alto, CA 94303	(415) 494-8844	CA	45 days	$15	Free	48	—	—	2%	2%	44%	8%	—	31%
Electronic Systems P.O. Box 21638 San Jose, CA 95151	(408) 448-0800	CA	None	$15	Free	114	6%	17%	25%	1%	2%	—	26%	4%
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INMAC 2465 Augustine Drive Santa Clara, CA 95051	(408) 737-7777	CA, IL NJ, TX	45 days	None	Free	80	—	—	1%	22%	15%	10%	—	36%
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MISCO 963 Holmdel Keyport Road Holmdel, NJ 07733	(800) 631-2227 (201) 946-3500	NJ	30 days	$25	Free	36	—	—	—	6%	31%	8%	—	42%
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E. D. Poe 941 Westwood Blvd. #201 Los Angeles, CA 90024	(800) 421-6657 (213) 879-5881	CA	None	None	Free	94	—	—	—	—	18%	—	—	22%
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Legal Protection for Firmware: The Generation Gap

by Elliott MacLennan, Attorney at Law
and A. Pierson Bates

What legal protection is available when you develop and sell computer firmware? Apparently the courts are as confused about this question as the computer industry is.

Computer technology and the law seem to operate in spite of each other. While the computer industry grapples with the problems of fourth-generation computers, the legal community is still grappling with first-generation questions: should software and firmware be protected, and what kind of protection should be given? For our purposes, firmware will be used synonomously with ROM, Prom and Eprom.

The annual investment in the creation and maintenance of software systems on a world-wide scale was estimated at $13 billion in 1977. The nature of software and firmware make them costly and time-consuming to create, yet cheap and easy to copy. It is easy to understand the reluctance of a manufacturer to spend thousands of dollars developing a computer chess program, when it may be copied by a competitor at a fraction of the cost.

If a programmer knows that he or she is protected against copying, the programmer will be more likely to disclose the concepts underlying the program. Disclosure of new ideas would tend to benefit society in general, and would reduce the duplication of effort and investment that occurs when new ideas are kept secret.

Proprietary protection also makes programs more marketable. The more marketable the program, the lower the unit price can be, still allowing the creator to recoup the initial investment outlay.

Various methods of protection have been suggested for software and firmware, including copyright, patent, trade secret, junior patent and other registration systems. Software has been described as a "square peg that does not fit into the round holes of either copyright or patent." Firmware and other integrated circuits represent a sort of slime to the legal community: neither a solid or a liquid, but still uncomfortably there.

Patent law grants a limited monopoly to the inventor of a novel and unobvious apparatus or process. The idea behind the invention is protected, and no one else may use the idea for the term of the patent, even if the other person develops the idea independently. The U.S. Supreme Court has looked with great disfavor on applications for patents on programs. In the 1978 case of Parker v. Flook, the court stated that a claim for an improved method of calculation, even when tied to a specific end use, is unpatentable subject matter.

Patent law is not the most appropriate protection for software because it is estimated that only about 1% of the programs written have the required degree of innovation for a patent. Hardware, on the other hand, has been recognized as patentable from its earliest development.

Trade secret law allows the owner of the secret to use the idea exclusively. This method of protection is used in licensing agreements, in which the owner gives another person the right to make limited use of the trade secret, and prohibits the user from disclosing the idea to others. This form of protection is widely used in the software industry, but it suffers from a major defect. Trade secret protection is valuable only as long as the idea remains secret. Accidental disclosure or independent discovery annihilate the protection. Because of this, owners of trade secrets must take extraordinary and expensive precautions to maintain the secrecy.

Copyright law protects the copyright owner from the unauthorized copying or distribution of the work. The

protection extends only to the author's expression of the idea. The author does not have a monopoly on the underlying concepts.

For example, two competing companies, X and Y, face the same problem. A programmer for Company X develops an original program to solve the problem, and the program is copyrighted. The programmer for Company Y independently develops a similar, or even identical, program. The Company Y program may also be copyrightable: the idea is not the property of Company X.

Firmware has characteristics of both hardware and software

A third programmer learns of one of the programs, realizes that the method used has application to a different situation and writes a third program using an idea from the copyrighted program. As long as the third programmer does not copy the protected program, the third program can be copyrighted as well.

Copyright protection is particularly appropriate to software. In developing software, it is estimated that from 5 to 20% of the investment goes toward developing new concepts, and from 80 to 95% of the investment goes into the blood, sweat and tears involved in writing the code, testing, debugging and documenting. The bulk of the investment is in the expression of the idea, and not in the underlying concepts.

Firmware has characteristics of both hardware and software. Like hardware, it is usually intended to be permanent, is physically fixed in the machine, and is invisible to the user. Like sofware, firmware contains a program. It usually makes no difference in the operation of the computer or in the end result whether the program is stored in ROM or in other types of memory.

Patentability of firmware

Firmware was held patentable by the U.S. Court of Customs and Patent Appeals in the 1979 case of Bradley and Franklin. In this case, Bradley developed an improved method of altering and repositioning information in the computer's system base or scratchpad memory. This was achieved by using a firmware module between the scratchpad registers and the system base located in the main memory. The patent application claimed that the invention was "a new and unobvious combination of hardware elements" that created a new machine.

In allowing the patent, the court pointed out that the patent application did not claim the information embodied in the firmware was patentable in and of itself, but rather a new "machine" was created as a result of

Taxation of Firmware

From the income tax perspective two interelated and critical questions remain to be resolved. Is firmware "property"? If it is, what is its character?

The significance of the seemingly obvious property question is that if it is, it can be transferred by sale or exchange. A sale or exchange of property creates the interesting prospect of obtaining capital gains treatment. If it is not property, its transfer will invoke the assignment of income rules so coveted by our taxing authorities.

When something is transferred that is not properly classified as property, capital gain treatment is categorically eliminated. Capital gains, to be sure, is the desirable goal because it is taxed 70% less than is ordinary income, i.e. the result obtained by the application of the assignment of income rules.

If you buy a bond you have bought property. Generally, a sale of the bond will produce capital gain. If you clip a bond coupon and turn it in for payment or sell or exchange it, you have not sold property; you have only transferred an income stream. This transfer can never produce capital gains.

A synthesis of American case law yields a principle notable for its lack of clarity. The principle is the more something appears to produce an income stream the less the chance it has of being classified as property. In fairness to our judiciary, with the unique form of widgets and arrangements modern day computer folk invent and engage in, it is often difficult, if not impossible, to distinguish what is and what is not property for tax purposes.

Section 1235 of the Internal Revenue Code provides a patent holder capital gains treatment upon the sale or exchange of all substantial rights to a patent. Although this Code Section is not necessarily the only way to secure capital gains treatment, it is what is commonly referred to as a safe harbor. There is no complimentary Code Section for copyrighted works. To the extent that firmware can be patented as a new machine, its classification as patentable property will produce substantially better tax results to its holder than will its classification as copyrightable.

The purchase or lease of new or used hardware can generate an Investment Tax Credit for its purchaser or lessee. This credit is a direct offset against your tax liability. Software, unless bundled with the hardware when sold or leased, is not entitled to an investment tax credit because it is said to be an intangible and only tangible personal property qualifies for the credit. Firmware presents an even more novel question. Is it hardware, software, or is its medium tangible with its instructions contained within intangible? There is no uniform consensus at this time between the varying taxing authorities. The answer to these yet unresolved questions will produce substantial economic impact upon all areas of the computer industry.

a combination of hardware elements, including some hardware elements that contained firmware. To be sure, some fancy footwork is required in order to obtain a patent on firmware by describing it as a new machine or apparatus.

The Patent Office appealed the decision to the Supreme Court. Oral arguments were heard in October, 1980. The Patent Office argued that the invention was nothing more than a computer program, which would not be patentable. According to the Patent Office, "firmware does not convert the conventional computer into a new, patentable machine."

Bradley argued that the Patent Office didn't understand the invention. The invention, according to Bradley, was a machine that could rapidly change the architecture of a computer to perform widely divergent tasks. Bradley urged that the invention be considered in its totality, without singling out one element: the firmware.

No decision in the case has yet been announced. Even if allowed, however, patent protection will only be available to the very small percentage of programs in firmware that meet the strict requirements of novelty and unobviousness.

Copyrightability of firmware

Firmware has a murky history in copyright law. The Copyright Office began accepting computer programs for copyright registration in 1964, under the policy of "when in doubt, register." Copyright registration does not ensure a valid copyright: only the courts can determine actual validity.

There are very few court cases dealing directly with copyrightability of software or firmware. The Copyright Law was overhauled, effective January 1, 1978, but most of the cases arose under the old law. Two cases based on the old law are Synercom Technology v. University Computing Co. (decided 1978) and Data Cash Systems v. JS&A Group (decided Sept. 80).

Synercom case

In 1970, Synercom developed and published a new manual and new input formats for use with its Stran program. The input formats were registered with the Copyright Office. In 1974, a competitor, EDI, developed a program that was wholly compatible with the Stran format. By using the format already developed by Synercom, EDI was able to save considerable time and money, and it was able to offer the package at a lower price.

University Computing Company had provided the hardware for use with Synercom's program until 1976, when Synercom and UCC had a parting of the ways. At that time, UCC teamed up with EDI to offer the competing package. UCC produced a user's manual for the EDI package. The manual contained mirror images of some of Synercom's input cards, and contined instructions that enabled the customer to use the Synercom input format. Synercom sued UCC for copyright infringement of its manual and input formats.

In copyright law, the expression may be protected, but the underlying idea may not. Where the idea is inseparable from the expression of the idea, there can be no copyright. The court in this case decided that input formats may be copyrightable if they communicate information and express ideas. However, the court held that in this case, the ideas or principles behind the formats were inseparable from the expression of these ideas: hence, no valid copyright.

Data Cash cases

In 1979, a federal district court in Illinois handed down an opinion that painfully illustrates the generation gap between the courts and technology. The judge decided the case on grounds that neither side had argued, used questionable assumptions, and clearly did not have a good understanding of the technology involved.

Data Cash Systems hired a consultant to develop a program for a computerized chess game, CompuChess. The game contained a ROM memory produced by General Instruments at the direction of Data Cash. The game was put on the market in 1977. The source program was registered with the Copyright Office, and every copy of the source program contained a copyright notice. There were no copyright notices on the game, the packaging, the literature, or on the ROM itself.

In 1978, Data Cash learned that General Instruments was manufacturing a ROM for another chess game. At the request of Data Cash, General Instruments tested the new ROM and found that it was identical to the CompuChess ROM. Data Cash also learned that the new chess game was being made by a Hong Kong company for JS&A Industries. Data Cash speculated that the CompuChess ROM was removed and decoded by the Hong Kong company, then either produced in printed form or used to program a Prom, which was then furnished to General Instruments to manufacture for JS&A.

Where the idea is inseparable from the expression of the idea, there can be no copyright.

In the district court opinion, the judge held that the ROM could not be copyrighted because it was a "machine part." This decision was based on a 1908 case which held that player piano rolls were machine parts (and not copyrightable) because the information was not in a form which others could see and read.

The judge reached his decision on the basis of the questionable assumption that object programs "enter into the mechnical process itself, cannot be read without the aid of special equipment and cannot be understood by even the most highly trained programmers." He recognized the fine line of distinction he was drawing between copyrightable material and "machine parts" and stated: "At different times, then, a given program is both source and object. The source program is a writing while the object program is a mechanical tool or machine part." The Data Cash controversy is evidence of the artificiality of this distinction. Because JS&A could obtain a copy of the object program by duplicating the ROM without copying the protected source program, there was no infringement.

Data Cash appealed the decision to the U.S. Court of Appeals and the decision was announced in Sept. 80. The appellate court paid little attention to the reasoning used in the lower court, giving it one sentence of consideration: "The parties had neither briefed nor argued that issue [that the ROM was a machine part] and neither side on appeal defends the district court's position, so we do not consider it further." The appellate court held that there was no infringement because of the lack of copyright notice on the Data Cash ROM.

First, the court determined that the case must be decided under the Copyright Act of 1909. The court held that sales of over 2,500 CompuChess games in 1977 constituted publication of the work by Data Cash. Since the publication occurred before the effective date of the new Copyright Act, the old act prevailed.

The requirements of notice in the old act were very strict. Publication without proper notice resulted in forfeiture of the copyright. There was an exception for limited publication without notice, in which case the copyright might not be lost.

Data Cash argued that the sale of the games in 1977 was a limited publication because Data Cash did not realize that the ROM could be copied. The court rejected this argument, ruling that the extent of publication is not based on the publisher's intent. As a result of Data Cash's innocent mistake or ignorance, the court held that the copyright had been forfeited. Under copyright law, ignorance is not bliss.

Because the court decided the case on the notice requirements, the court impliedly held that the object program in the ROM was copyrightable. If the program was not copyrightable, there would be no question of notice. However, because the court did not directly address the copyrightability issue, the case gives no clear guidelines for firmware developers to rely upon.

New copyright act

The Copyright Act of 1976 gives the copyright owner various exclusive rights, including the right to reproduce the work, to prepare adaptations of the work, and to distribute copies of the work. Copyright protection is available for "original works of authorship fixed in any tangible medium of expression...from which they can be perceived...either directly or with the aid of a machine or device."

This protection begins as soon as the work is "fixed in a tangible medium of expression." Protection may be lost, however, if the work is publicly distributed without adequate notice. The notice must be placed on copies of the work so as to give reasonable notice of the claim of copyright, such as on the page following the title page of a book, or more importantly, visually perceptible to the human eye on the firmware itself.

The language of the Act is broad enough to include both software and firmware. For example, the definition of literary works includes "works expressed in words, numbers, or other verbal or numerical symbols or indicia, regardless of the form in which they are expressed." Included in the examples of forms of literary works are tapes, disks and cards.

The definition of copies which is used to define both the original and any infringing works, includes objects "from which the work can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."

In spite of the broad language, the copyrightability issue is far from settled. The Act contains a section (one of the shortest sections in the entire Act) which thoroughly muddies the waters. In effect, Section 117 states that the new Act does not apply to "works used in conjunction with computers." To confuse things further, the House of Representatives Report accompanying the Act states that "with respect to the copyrightability of computer programs, the ownership of copyrights in them, the term of protection, and the formal requirements of the remainder of the bill, the new statute would apply." Apparently, Section 117 is limited to the possibility of infringement by use of a work in a computer, although this conclusion is by no means self-evident.

The notice must be placed on copies of the work... visually perceptible to the human eye...

This section was enacted because at the time, Congress was not prepared to change the status quo with regard to the use of works with computers. The National Commission on New Technological Uses of Copyrighted Works was formed to study the issue. CONTU presented the final report on July 31, 1978, and legislation is now pending to amend the Copyright Act in accord with the recommendations of the Commission. This bill is expected to pass with little opposition.

CONTU recommended that the Copyright Act should be amended (1) to make it clear that original computer programs are copyrightable; (2) to delete Section 117; and (3) to assure that rightful possessors (the legislation uses owners) of copies of computer programs can use and adapt the programs for their own use.

This third provision is included because CONTU recognized that most programs require some customizing or translating before they are usable. Without this provision, translating a copyrighted source code into object code, or vice versa, could be illegal. Under the Copyright Act, inputting any copyrighted work in a computer is preparation of a copy and is a potential infringement. With the third provision, the rightful owner of a copy of a program can input the program for his or her own use legally.

The CONTU report includes flow charts, source codes, object codes within the scope of copyright, making explicit what Data Cash only implied. The report also addresses firmware, stating that programs stored in memory may still be copies: "When a program is copied into the memory of a computer it still exists in a form from which a human-readable version may be produced. That is, the copy in the computer's memory may be duplicated, just as a version listed on paper or coded on magnetic tape may be."

Although this passage does not distinguish ROM from other types of memory, the report later specifically

mentions firmware. In discussing proper forms of notice for machine-readable copies, the report recommends that notice be placed on "semiconductor chips in which programs are stored." The waters are beginning to clear.

Until a more definitive court decision, or until specific legislation is passed, programmers and lawyers can only make educated guesses as to the parameters of firmware copyrightability.

Other registration proposals

Two similar registration systems have been proposed recently to protect computer programs: the IBM system and the Japanese MITI proposal. Both systems would give a type of copyright protection, protecting the expression of the idea but not the underlying concepts.

Both systems would require that a description of the program be submitted for registration. The MITI proposal calls for an outline of the program, and the IBM proposal requires a detailed conceptual description of the program. The IBM description would be required to be detailed enough that a skilled programmer could take the descriptive material and write a program using the concepts as described to do substantially the same thing as the registered program does. These outlines or descriptions would be available to the public.

The IBM proposal would also require the deposit of the program in either source or object code. The program would be kept secret for the term of the protection (suggested between 5 and 10 years), or would be made public, depending on the wishes of the owner of the program. This proposal differs from the present Copyright Law which requires that two copies of the program be deposited with the Library of Congress (with no provision for secrecy). The IBM proposal also specifically includes protection for programs stored in memory, including ROM.

Under existing American copyright law, the copyright owner bears a difficult burden of proof. The copyright owner must prove that the copyright was valid, that the alleged infringer had access to the protected work, that the alleged infringer copied the protected work, and that there was a substantial similarity between the protected work and the infringing work.

The MITI proposal adds an interesting twist, in that the burden of proof would shift to the other side. The alleged infringer would have to prove that the similar program was not created by an act of infringement.

Both registration systems have been criticized for being too cumbersome and expensive. They have also been attacked for not protecting the underlying concepts by those who prefer patent-type protection.

Copyrightability of integrated circuits

In the Data Cash case, if the ROM had been copied by photographing the layout of the chip, there would probably be no remedy under copyright law or under the CONTU revision. The Copyright Act only allows protection for designs to the extent that the artistic elements "can be identified separately from, and are capable of existing independently of" the utilitarian aspects of the design.

This is part of the law's distinction of expression from the underlying idea. Architectural plans can be copyrighted, but it is not an infringement to build a house based on those plans (as long as the plans are not actually copied as plans). A fabric design may be copyrighted, because the artistic elements can be separately identified from, and can exist independently of the useful article (the garment). Therefore, a pattern on a $10 tropical print shirt may be copyrighted, but the patterns on the IC you design, worth thousands of dollars, may not be copyrightable.

Legislation was introduced in 1979 to amend the Copyright Act to include photographic masks used to imprint patterns on ICs, and the imprinted patterns themselves, even though they are used in a "useful article." The Bill was referred to a Congressional committee, from which it never emerged. Perhaps a more polite way of saying this would be to say that the Bill is missing in action. The semiconductor industry is divided as to the wisdom of this approach. It is not likely that such legislation will be passed in the near future.

A British group, the Committee to Consider the Law on Copyright Design, studied the problem of design protection and presented their report in 1977. Of the nine committee members, seven recommended that copyright protection for useful designs be allowed. Three of the seven proposed a registration and deposit system (similar to the regular U.S. procedure), and the other four favored automatic protection without formalities (under the regular British copyright system).

Japan has another system: the junior patent system (Utility Model Law). Under this system, patent-type protection of an idea is granted, with more lenient requirements of novelty, for a shorter period of time than regular patent law. This protection is available for any new device capable of industrial use and relating to the shape, structure or assembly of an article. The term of protection is 10 years from registration, subject to the payment of annual renewal fees from the end of the third year.

Utility model registration protects the underlying idea, and, in practice, covers "equivalent means" as described in the registration. The Utility Model Law specifically includes electronic circuits within the scope of its protection, and allows protection for "the construction, a configuration of elements used for effecting the construction, or a combination of both."

Summary

At present, copyright protection is the most appropriate form of protection for software and firmware, although copyright infringement is hard to prove. The Japanese proposal for shifting the burden of proof on to the alleged infringer would make copyright protection easier to enforce, but goes against our tradition of "innocent until proven guilty."

Protection is needed for the patterns on integrated circuits. Design protection, similar to the Japanese utility model, is an appropriate form of protection, but is unlikely to be enacted in the near future in this country (it took over 20 years to overhaul the Copyright Act).

Above all, the legal community, Congress and the judiciary must endeavor to close the generation gap existing between rapidity of technological developments, on the one hand, and the outdated legislative and legal machinery interpreting those developments. □

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Now the Japanese OEMs Take on the Americans

by Mathew Tekulsky

Japanese companies are becoming increasingly involved in the American original equipment manufacturer marketplace. It's difficult to estimate their share since it depends on what products you're talking about, and shifts in the marketplace; at this point it's relatively small. However, Japanese OEMs are emerging as a powerful source.

"Japanese products are accepted by many buyers because of the high quality of the computer products; we're doing very good business," says the assistant manager of the sales department of a major Japanese firm, who adds that the "great demand" for Japanese OEM products hinges on their lower price tags, attributable to several factors: Japanese workers are highly educated and homogeneous—quality control is more easily attained than with the heterogeneous American labor force; Japanese workers stay with the same company for almost a lifetime, so they establish exacting experience; the Japanese invest a lot of money in manufacturing and design, hence production is more efficient and results in a better yield rate.

Since the Japanese are known for quality production, buyers realize that they're getting the Japanese product, even if the brand name is American. These people are buying the Japanese product *intentionally*.

A spokesman for the Hitachi Semiconductor Division, which makes many semiconductor items, pointed out that there's a perceived lack of quality in U.S. products and a perceived higher quality in Japanese products, so consumers "go out of their way to buy Japanese." Indeed, there's reportedly a 10:1 qualitative difference between the Japanese semiconductor and its American counterpart. If there are 10 failures out of 1000 with the Japanese semiconductor, there would be 100 failures out of 1000 with the U.S. product. By using the Japanese semiconductor, therefore, the second buyer can eliminate certain inspection processes and cut down on costs, the end user can receive a product that requires less maintenance, and the distributor can benefit because less money is spent on servicing. It helps everyone down the line.

Why are the Japanese companies moving into the American OEM area? Because of the large market. It's that simple. Norio Sugii, national sales manager for data recorders at Teac, says that while his company sells 1000 to 3000 floppy disc drives and cassette tape transports (each) per month in Japan, he expects to sell ten times that number worldwide (10,000 to 20,000 units per month), 70 to 80% of which is to the U.S. and 20 to 30% in Europe.

Sugii points out that the OEM marketplace differs from the automobile and camera markets; OEM sales are not determined by individual consumer decisions but by company policy of the secondary purchaser. Thus, if the company's engineer likes the Japanese product, top management may still prefer a U.S. product.

In order to compete with American products, he states, their Japanese equivalents must be of very good quality and reasonably priced.

In addition, there's the necessity of having servicing and response on request from the purchasing company. Thus, if the Japanese company has no branch office and service facilities in the U.S., it can't continue to supply the domestic market. It should be noted that the spokesman for Hitachi Semiconductor states that the Japanese are simply accessing the market and are building what it wants. There is not necessarily a cheaper price tag for their products.

Japanese OEM products most in demand include terminals, printers, microcomputers, and microprocessors. According to the assistant sales manager of the major Japanese firm, annual growth in these areas (in general) is close to 30%. But the growth is greatest—and there is most activity right now—in the semiconductor field, although the Japanese market share is still small compared to the U.S., which is the largest supplier in the world.

"The Japanese share in the semiconductor industry is changing all the time, and growing," says the spokesman for Hitachi. "Two-and-a-half years ago, Hitachi had no semiconductor market, and now our share in 16K-bit NMOS dynamic memories is substantial."

Although Teac doesn't make semiconductors, it does make floppy disc drives and cassette tape transports. And while its share of the U.S. market is small (it's only been selling units for two years, and concentrated on the Japanese market first), Sugii contends that the "good quality and low defective rate" bodes well for the Japanese product.

Hitachi concentrates on the high end of the market, and makes mainframes, large CPUs, PCM and non-PCM systems, sophisticated colorgraphic terminals, as well as 3350-type disc drives and 3420-type tape drives.

But its share in the U.S. market is small, since IBM has over a 60% share, and only 10% of that consists of the high end.

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Third-Party Software: Opportunities on the Horizon

by Mathew Tekulsky

There is a trend among hardware manufacturers to solicit software from third parties, and market that software with their systems. Software is also sold by third parties to systems integrators and to computer stores, to market with hardware. Whichever way it gets there, the practice of providing software with the final product not only makes it easier and faster for the end user to use the computer, but has a significant effect on the marketing of that product.

"We are working with a variety of third-party software authors in the three basic areas of home financial resource management, education, and entertainment programs," says a spokesman for Texas Instruments, which is primarily involved in the home microcomputer market. "We are actively looking to develop third-party software, to work with third-party software authors, and to use their level of expertise in whatever manner is mutually beneficial."

Accordingly, TI has "no specific approach" to the incorporation of software into its systems. It will market the software under the TI name, or will provide an outside brand of software, including brand name and promotional literature, with the TI computer.

It also markets software through its own catalog. The company seeks to "balance the strengths we have internally" with outside consultants, and it hires university professors, among others, to provide TI's internal software experts with guidance on how to write particular programs, i.e., for educational and professional use.

Thus the situation is very flexible for the third-party software provider. Much of the software solicited depends on who the end user is and who the third-party authors are. Within those broad guidelines, however, it seems as if anything can happen.

Lifeboat Associates, the largest distributor of software in the world for microcomputers running under CP/M, sells customized CP/M operating systems for specific computers, and also distributes software that it and others write for micros that run on the CP/M operating system. It sells very little software to manufacturers, however, and a great deal to dealers—systems integrators and computer stores primarily.

According to a spokesman for Lifeboat, the company's branch of customers is wide. "We sell software for 85 different computers, and we sell it around the world. Some software is large and won't fit on a small disk, but in general we have a wide choice available, with a lot of utilities." He states that marketing software alongside hardware is "a widespread practice," and since there are numerous micros running under CP/M, it's a large market.

"I see manufacturers purchasing software," he adds, "but I don't see it being effective. It's inferior to what's being distributed independently. The manufacturers do not have the spontaneity of independent consultants and software houses. Manufacturers are conservative, unmodified, and not altogether state-of-the-art and because of their distribution channels, software can sit in warehouses for three months and go out of date."

The spokesman for Lifeboat points out that when software is included with a system, "all of a sudden you can do something with it (the system). The only thing the end user comes in contact with is the software. Most end users should be indifferent to the technology (of the hardware). Software is much more important from the point of view of the user. The software will make or break his system."

According to TI, the benefit of the third-party software trend, for the end user, is that he has the software available. "The solid-state software that we offer is the basis for the ease of use of our computer. The software is permanent, and it can't be destroyed unless it's physically destroyed. You plug it in and you have immediate access—ten seconds from programming to implementation—and it has plain English prompts. Our software library is growing rapidly. There are 30 different programs, with more on the way. The advantage to the end user is the variety of software available for a particular computer."

And what about the ramifications on the marketing of computers of having software available with the hardware?

"A major asset in the sale of any computer, and especially personal computers, is the ease of use of the hardware," states the TI spokesman. "We concentrate on the home market, and a good, broad-based library of quality software is essential."

According to TI, the intention of the manufacturer is important in determining what software will be available. Is the manufacturer interested primarily in the professional market? The small business market?

TI is involved primarily in the home market; its software is developed with a language for home use. However, if a lawyer, doctor, or other professional wants to buy peripherals and store business records, he can.

Continued on following page

Third Party Software

The computer, however, is not designed primarily for that, but as a home enrichment tool that can be used by all members of a family. Similarly, TI's educational programs designed for school use must have software that students, say, in the third grade, can use on their own level. In this respect, the command modules that plug in make the machine very accessible for the user.

Both TI and Lifeboat, it is interesting to note, are expanding their software operations. TI is now more specialized, so there are more opportunities for third parties to develop and sell software to them. Meanwhile, although most of Lifeboat's software is for micros, it's now starting to do minicomputer software.

Perhaps the TI spokesman summed up the situation best: "The manufacturer doesn't have to provide all of the software. We don't, and no company would have the resources to supply all of the software needs for all of the applications to which a personal computer can be put. If there's no software available, the hardware won't sell ."□

Japanese OEMs

One Japanese OEM product doing quite well is the Spinwriter printer made by NEC Information Systems. John Cooper, NEC director of marketing, explained that by the end of 1980, the Spinwriter had captured 80% of the fully-formed character market, up from zero three years earlier. "We feel very comfortable about that. We hold an excellent reputation for reliability and quality, and we've received very good brand and trade name recognition."

But what about Japanese companies becoming more involved in end-market sales?

"Japanese companies have the capability of manufacturing a good quality product, but they do not have the power to market in the United States," says the assistant sales manager of the major Japanese firm. "Eventually, maybe they could sell *themselves*, but right now they're marketing as OEMs. OEM is an easy business. You don't need a service or marketing force, so you can concentrate on manufacturing."

Clearly, although many Japanese companies are concentrating on OEM, many others have their eyes set on becoming end-user suppliers for the American market. But the U.S. is very big, so it takes time to expand.

Japan, like the United Kingdom, has to export products to survive. It has always studied the world and designed products for specific countries. And as the Japanese auto industry designed cars for the American market, so the Japanese computer companies are concentrating on the American computer market, both as OEMs and as end-user suppliers.

"We may have a dream," said the assistant sales manager. "It may take 10, 20, or 30 years, but if you take a Japanese company and you service end users, you're not a Japanese company anymore. You will be a U.S. company. You just manufacture in Japan, or another part of the world. IBM manufactures all over the world, but how do you call IBM a U.S. company? It's an international company."

For basic economic supply and demand, the end user is going to get what he wants, and the Japanese are ready, willing, and becoming more and more able to supply it.□

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The OEM: How to Grow in the Micro Market

by Bernard Conrad Cole

The personal/home computer marketplace has grown dramatically in the last few years and is expected to grow at an explosive rate for the next few years. But even the most optimistic do not see a market by the mid-80s that will much exceed 5 to 6 million units in homes across the U.S. While this is a respectable number, it is hardly "mass market" in the traditional sense, even though dollar volume sales will exceed $6 billion by 1985.

And until there is a considerable amount of education of the ordinary consumer in the use of personal computers or until the manufacturers of personal computers make them sufficiently easy to use, the market is expected to reach a saturation point and be unable to grow significantly until well into the 1990s.

But it is a mass market—and the large number of users it implies—that is required if the majority of personal and home computer manufacturers now in existence are to continue to survive. The market must be large enough to allow the computer systems to be produced in large enough quantity such that the cost per system can be reduced.

This kind of market is a certainty by the mid-90s as the average consumer slowly becomes educated in the use of computers and as the technology advances to the point that personal computers will be so simple to operate—so "friendly"—that even a novice can use them.

But if the majority of personal computer manufacturers now in existence expect to survive, they cannot depend on the natural evolution of the market. They must find some way to accelerate it or to expand their customer base to include more than just the traditional hobbyist and home computer user. This means moving into the small business and industrial markets.

As a result, most personal/hobbyist computer manufacturers—from industry leaders such as Apple, Tandy (Radio Shack) and Commodore to companies of more moderate size such as Ohio Scientific and Intelligent Systems Corp. (Compucolor)—are reassessing their traditional marketing channels.

Key in their deliberations is how to most effectively make use of an existing base of original equipment manufacturers (OEMs) to reach a large base of end users.

Before we go any further it would be useful to define what is meant by OEM and end user. The definition depends on which market is being considered and from whose perspective. From the point of view of the supplier of microprocessor components and board level computers or the supplier of various peripherals such as disk drives and printers, the personal computer manufacturers are OEMs.

To the personal computer makers, the end user is the individual purchaser, the hobbyist, the computer enthusiast, or the professional for use at home or at work. In the more traditional business and industrial markets, the end user is usually an organization or corporation which has purchased more than one—anywhere from two to hundreds—for use in a variety of internal functions.

Broadly defined, an OEM is an individual or organization which purchases a component—in this case a personal computer—and adds value in the form of software, hardware or expertise in customizing a general purpose system for a specific application.

Traditionally, OEMs have been the way manufacturers of large mainframes and minicomputers have penetrated new markets. And it is the way personal computer manufacturers, in varying degrees, are looking to expand their customer base.

The OEM in the personal computer market is usually a software consultant, a system integrator, or the computer retailer, such as ComputerLand or Computer Center. Even when the manufacturer has established its own direct sales force to sell directly to the end user, this channel of distribution usually exists side by side with the already established OEM.

The distribution channel for personal computer, in general, falls into four basic categories, each of which performs an OEM-like function in varying degrees:

Computer Retail Stores. The initial hobby orientation of the microcomputer industry led to the growth of the computer retail store. Currently between 500 and 1000 exist nationwide. Traditionally they have provided customized services to their customers and are coming to serve more as OEMs, adding significant value to the complete personal computer system before it reaches the end user.

Office Machine Dealers. These outlets sell and service office machines to small businesses and institutions in different regions of the country. Sales through this channel are presently low, due primarily to the dealers' lack of knowledge about both microcomputer products and technical electronic repair. Little value added in the traditional OEM sense is performed through this channel.

Distributors. This is the major method of intermediate distribution throughout the U.S. They usually have better financing than computer retail stores and can deal in larger quantities of merchandise. In addition, they usually provide warehousing, delivery, and credit to retailers. Most notable in this group are Byte Industries, ComputerLand and MicroAge.

Manufacturer's Reps. These firms typically represent manufacturers in a given region or established specialized market. Noncompeting products from several companies are represented—several personal computers, different types of terminals and printers and a variety of floppy and fixed disk storage drives—all from different companies which are then configured into the optimum system for the end user.

The degree to which manufacturers of personal computers are, or will, use these various OEM channels will vary, depending on the traditional strengths of the company involved.

A company such as Tandy, with a nationwide network of retail stores (Radio Shack), has depended on this well-established distribution channel to establish a dominant position with 35.5% of the market (110,000 units). The use of OEMs is not presently being considered in the marketing of the TRS-80 family.

With a newcomer such as instrument and minicomputer manufacturer Hewlett-Packard, emphasis is being placed on its nationwide direct sales force to market the HP-85 in markets where it is already dominant, such as scientific and laboratory applications, and in instrumentation control in a wide variety of industries. In relation to the HP-85, OEMs, be they retail computer stores or system integrators, are being used only to establish a presence in the personal computer market.

In between are companies such as Apple Computer, with 27.4% share of the personal computer market (65,000 units), Intelligent Systems Corp. and Ohio Scientific, who are placing greater and greater reliance on the OEMs to establish their products in new industrial and business applications. The strategy they use varies from company to company.

According to David Deans, vice president of marketing at Intelligent Systems Corp., the personal and hobby computer industry in general has underestimated the time it would take for mass consumer demand to mature. As a result, he says, all are faced with developing strategies that will allow them to survive—indeed, thrive—until it does.

"We all expected to come to maturity by the early to mid-1980s," says Dean. "We all underestimated the steepness of the learning curve on the part of the general public. It now looks like the sales in large numbers will not occur before the late 1980s.

In the interim there is fortunately, he says, a market for the personal computers customized and dedicated to requirements of individuals in a variety of professional, business and industrial applications.

"Over the near term, this interim market is potentially as large as the home computer market," says Dean. The users will range from vice presidents of finance who will use a personal computer for financial calculations to the director of manufacturing who will use it to track the production process and inventory flow. "To do these sorts of diverse functions requires software that meets the specific requirements of each market area," says Dean. "Key to the development of this specialized software is the existence of intermediaries —OEMs—who understand the specific application area and can develop the necessary software."

The retailer as OEM

Intelligent Systems, he says, is attacking the industrial market through a variety of systems integrators who serve in an OEM capacity—ranging from the two or three person "cottage industry" to the computer retailer with specialized knowledge of industries in his service area.

Computer retailers may serve as an OEM addressing potential applications in a horizontal fashion, serving as the interface to a number of industries in a specific geographical location. Systems integrators, on the other hand, he says, serve in the same OEM capacity vertically, devoting their expertise to specific industries. One may specialize in hardware/software "packages" for the drug stores, another for automotive trade, hardware stores.

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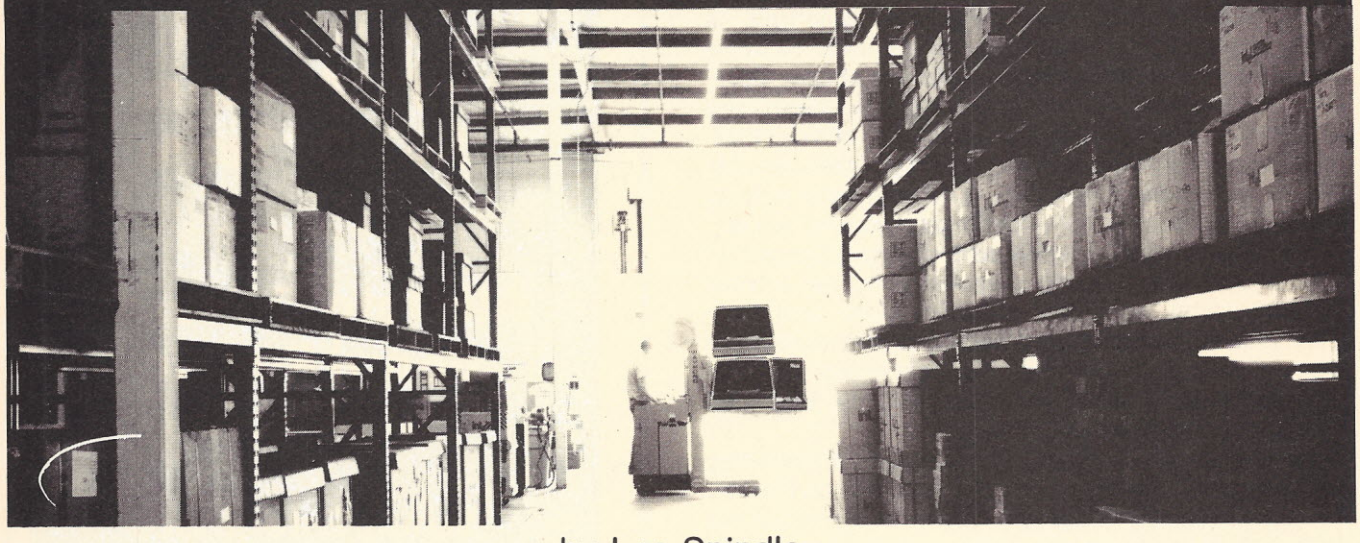
The Distribution Game: Man in the Middle



by Les Spindle

Terminology in the dynamic, fast-paced computer industry is as tricky a proposition as the technology it represents. One man's 'micro' is another man's 'mini'; 1981's state-of-the-art may well turn out to be 1982's Edsel. Merchandising jargon is no exception. 'OEM', 'dealer', 'systems house' and 'distributor' are all terms relating to the microcomputer marketplace. But their territories overlap so frequently that no isolated interpretation seems definitive.

To pinpoint the role of the commercial distributor in the complex web of microcomputer merchandising, IA visited Hamilton/Avent in Culver City, CA for some insight into how the middleman fits into the labyrinthine scheme of things. What is the role of the systems distributor and what is his eventual impact on the end user?

H/A seems a typical example in the sense that it has over 20 years experience in the distribution field. It seems atypical in that it has only recently ventured out of the industrial—into the commercial—marketplace. A leader in the distribution of all manner of electronic components, H/A includes 42 locations in the U.S., Canada and Japan and recorded gross sales of nearly $800 million in 1980. Why has a giant in the wholesale components business elected to delve into the quite separate waters of commercial systems distribution?

According to H/A president Anthony Hamilton, he felt that the computer line was necessary in order to keep pace with the electronic revolution and to meet the changing needs of his customers. Traditionally, H/A had been strictly an OEM supplier. An OEM sales transaction involves a product or component being sold to an industrial supplier for the purpose of integration into a finished product for resale.

Dick O'Melveney, vice-president in charge of computer marketing, describes the evolution process leading up to H/A's retail dealer program. "We first became involved with the microcomputer industry when Intel developed the chip in 1973. When we saw what was happening, Tony Hamilton told me specifically to take a separate assignment and find out what impact the microprocessor would have on distribution. In 1976, we started a separate organization for computer products and began to focus in on it. The next logical step was sales to retail outlets. The program was only introduced in early 1980 and already includes some 330 dealers. Today, 14% of Avnet's total sales are in computer-related products."

O'Melveney views the testing of commercial waters as an attempt on H/A's part to provide customer service that a strictly industrial supplier was not equipped to do. "We wanted to set up a mechanism so that we could refer customers to somebody. We wanted to get involved with the retail channel to give the end user who comes to us for assistance a place to go that was better equipped to deal with his problems."

What, in turn, does H/A offer for the retailer? Two big advantages are storage and shipping facilities, according to O'Melveney. The retailer can alleviate the headaches of excessive cash outlay and storage space by turning to a distributor to fill his orders. H/A promises delivery to its dealers within 48 hours.

Three major manufacturers currently supply the product line: Centronics printers, Hazeltine video display terminals and Novation modems, but O'Melveney hints that the list of manufacturers offered will soon broaden. And, through its industrial components division, Avnet has access to various computer parts from many manufacturers: Advanced Micro Devices, Intel, Digital Equipment Corp., Motorola, National Semiconductor, RCA, Rockwell, Shugart, Opto-22 and Burroughs.

Through the distributor, the retailer has access to a wide range of equipment on short notice. O'Melveney cites a hypothetical example: "A dealer may not know which printer a customer may want. He demonstrates one to a customer, who wants it, except with a heavier duty cycle, a lower cost version, or whatever. He can come to us and get that other printer quickly without having to have it in his inventory."

In a similar vein, the distributor alleviates the retailer's worries on time-related planning. "The lead times on

systems product—printers, mass memory, CRT terminals and other products—are highly variable. This poses a critical path problem. This is where the distributor comes in. A fast growing company will have trouble finding the time to do the planning. With electronic parts, substitutions of resistors, capacitors, etc. for unavailable parts, are much simpler. But, with computer parts, fewer second sources are available. Quantities of products being produced are more limited and there is always the matter of equipment compatibility.'' says O'Melveney.

Another important advantage that O'Melveney points out is the matter of credit terms. Few manufacturers are willing to work with retailers on anything except C.O.D. arrangements. One option in the H/A program is the practice of flooring plans. This involves the financing of inventory by an outside agency so that the dealer can purchase goods on a 90-day financing plan, paying the agency only the interest on the stock for the first 90 days, freeing up the cash flow considerably. ''But a lot of it is just the manipulation of day-to-day credit. That accounts for a lot of our business,'' says O'Melveney. ''A net 30-day billing schedule is another option.''

David Peterschmidt, dealer program manager, cites clout with the manufacturers as a big plus. ''By working with the largest electronic distributor in the world, dealers can voice their concerns and needs to manufacturers through us and get the services they require.''

O'Melveney recalls a problem encountered with Centronics on its 730 printer. Centronics' policy was ''return to depot for repair'' when defective products were delivered. O'Melveney says ''They only had 12 depots and several of the dealers were frustrated with dead-on-arrival equipment. Even in Los Angeles, a trip to the depot could be a four-hour drive each way to get the thing fixed.'' Avnet approached Centronics with the idea of advance-replacing the DOA products, and having Avnet take several printers to the repair depot in one batch. The plan was soon implemented, much to the dealer's relief. ''The retailer has the opportunity to meet with us on a face-to-face basis to discuss product needs, technical information and customer service,'' says O'Melveney. ''He can beat us on the head and say 'do something' instead of talking to an obscure voice at some 800 number.''

Consumer education needed

The oft-repeated woe of consumer (and retailer) lack of technical knowledge is another area where the distributor is offering support. O'Melveney dislikes the term ''computer literacy,'' referring instead to ''inflated customer expectations.'' He feels a lot of the advertising and press coverage on computers have painted an unrealistic picture for the consumer on what the equipment can—and cannot—do. He relates an incident in one of the company's demo centers. ''A customer came in to look at a Fairchild design tool that was advertised for $9.90. When he walked in, he saw a complete unit with floppy disk, HP terminal, and the mainframe unit and exclaimed, 'That's what I get for $9.90?' It was a $15,000 piece of gear!''

The public's education in computer knowledge, of course, should start with the salesman offering the product. O'Melveney criticizes some dealers for looking only at price, fast delivery, and other factors which, however important, are not the whole picture. He feels

that the commitment to customers includes a closer look at the type of suppliers that the dealers are working with. "They need to understand the distributor and his position. The logistics of selling products, the warranties, the support are all as important as 'how fast can I get it and how cheap?'"

Mike Roth, technical marketing manager, says that he has noticed a correlation between success in a microcomputer based product and the commitment made by the user. "Companies willing and able to make the investment in a complete set of development tools have found that it paid off. By contrast, those that have skimped on development hardware and software seem to have hobbled their chance of success."

Roth describes the educational programs that Avnet is implementing to help business managers understand the computer revolution and prepare them for change and growth. "The educational materials will fall into the classification of product studies. We have tried to detail examples of customer needs and how they can best be met with specific products from our suppliers."

Other distributors have implemented more ambitious educational support. High Technology, Inc., Oklahoma City, OK maintains a telephone hot line to answer questions from its dealers and end users. Mike Witter, editor of *Computer Retailing*, views the educational service as one of the most beneficial aspects of the distribution process, one that can only provide positive results for the retailer and the end user alike.

Other services that distributors offer include advertising support on national, local and in-store levels, promotional programs with incentive awards for sales performance, recording and filing of warranty serial numbers and standardization of satisfactory warranty agreements.

In the pipeline that travels from component supplier to hardware manufacturer to OEM to system integrater to a completed system for the end user, the distributor,

thus, plays a vital role. A recent report by Strategic Business Services, San Jose, CA (*Strategies for Distributing Business Computers: The Emerging Middleman)* indicates that the distributor provides far greater coverage with far lower cost of sales to a manufacturer than he would experience dealing with retailers and OEMs. Retail and industrial distributors together account for 50% of computers sold, according to S.B.S., which projects that the figure will rise to 75% by 1984. Strictly independent wholesalers such as MicroAge in Tempe, AZ and High Technology have a foothold in retail distribution, but are now facing formidable competition as such traditional OEM distributors as Hamilton/Avnet enter the ballpark.

The retail dealer has to build pipelines and solid support for the future.

"As this business grows," says O'Melveney, "the retail dealer will have to focus most of his time and money on his customers and his own growth expansion. He has to build pipelines and solid supports for the future. In order for his customers to enjoy the service they need, he has to know that his orders can be filled promptly and efficiently. And he has to know that if he gets into trouble, there's going to be somebody there to help bail him out."□

LOOKING AT COMPUTER STORE FRANCHISING

by Julie A.K. Ross

MicroAge Computer Stores, Inc.
1425 W. 12th Pl., Tempe, AZ 85281

While relatively new to the computer industry, franchising has long been big business in American enterprises. In 1980, franchised operations accounted for one-third of the total U.S. retail trade, translating into some $380 billion. Additionally, Department of Commerce figures show a remarkable 95% success rate for franchises, while independently opened businesses can expect only a 20% chance of survival. It is easy to conclude from these figures that a well-supported, recognizable corporate image can make the difference between failure and success in a new business.

In recent years, numerous computer companies have jumped on the franchise bandwagon, notably MicroAge Computer Stores (Tempe, AZ), ComputerLand (San Leandro, CA) and On Line MicroCenters (Hayward, CA). ComputerLand and On Line are targeted primarily towards the personal home computer market and MicroAge towards the small business/professional field.

In January 1980, MicroAge initiated its franchise program. The company is highly selective concerning the quality and abilities of franchise applicants and, in return, offers a number of benefits.

One of these special features is the training program offered through the firm's learning center. The course runs for three weeks, encompassing more than 130 hours of formal training, and covers microcomputer technology, systems, business applications software, advertising and promotion, marketing and sales training. Additionally, one full week is devoted to franchise management instruction, including small business

COST COMPARISON AMONG INITIAL INVESTMENTS

INITIAL INVESTMENT	MICROAGE	COMPUTERLAND	ON LINE
Franchise Fee	15,000	5,000-20,000	15,000
Store Design & Implementation	n/a	10,000	n/a
Leasehold Improvements	5,000-10,000	3,500-12,000	15,000
Furniture & Fixtures	22,000-25,000	8,500-23,000	8,000
Equipment & Machinery	3,000-5,000	n/a	n/a
Initial Inventory	40,000-50,000	20,000-70,000	50,000
Lease & Security Deposits	n/a	n/a	1,000
Exterior Sign	n/a	n/a	800
Deposits & Prepaid Expenses	n/a	3,500-5,000	n/a
Miscellaneous & Working Capital	20,000-45,000	10,000-25,000	15,000
Insurance	n/a	n/a	3,600
TOTAL	105,000 to 150,000	60,500 to 165,000	108,400
Royalty Payments:			
1st year	4%	8%	4.5%
2nd year	4%	8%	5%
3rd year	4%	8%	5.5%
Thereafter	4%	8%	6%
Advertising Fees	1%	1%	1.5%

management, cash flow, retail operations, field support and operating a service center. A day is also provided for field training in an operating store.

Procedural manuals containing guidelines and specifications as to store development, advertising and promotion, technical service and sales techniques are provided at the learning center.

The corporation also develops, produces and implements advertising campaigns for franchisees focusing on professional computer sales designed to target specific vertical markets. Additionally, franchisees receive assistance in grand openings and advertising and marketing support on an ongoing basis.

Product quality pretested

A unique service is a research and development division that thoroughly tests and evaluates products before they are recommended to the stores. This saves the franchisees considerable time and effort in selecting the products they choose to carry. In an industry where products are complex, and change is the norm, this is extremely valuable. Additionally, new product information and technical support bulletins are provided monthly.

Other features include assistance in site selection, initial inventory consulting, inventory discounts, financial review, aid in lease negotiations, liability insurance and access to resource support personnel.

Unlike the small business/professional marketing approach, ComputerLand, which began selling franchises in 1976, is primarily interested in the home, hobbyist and educational computer user. The company has more than 100 store locations nationally and 24 outside of the U.S. According to Michael McConnell, vice president of marketing, the company expects to open 50 new stores per year.

Franchisees buy most of their inventory from the franchisor, which is passed through at cost in return for an 8% royalty on total store sales. This wholesale price break is perhaps the biggest selling point. Each franchisee is required to undergo a two-week training session prior to opening a store, involving about 70 hours of formal class time. ComputerLand franchisees are also required to purchase a store design and implementation package at a cost of $10,000. This package covers the costs associated with the formal training program, in addition to architectural design, signs, start-up supply of stationary and forms, expense of visits by company personnel to the store site and various interior fixtures. Guidelines on site selection, lease negotiations, financial planning and interior design are also made available to franchisees.

A newcomer to the business is On Line MicroCenters, which began operations in 1980. On Line has one company-owned store in San Jose, CA.

On Line is also directing most of its energy toward reaching the home user. Corporate literature states that store location strategy is designed to place sites in shopping centers and malls.

The company requires franchisees to participate in a two-week training program covering topics such as retailing methods and marketing techniques. Additionally, architectural design, promotional materials and a decor package are provided. In almost every aspect of the program, personal computers are emphasized. □

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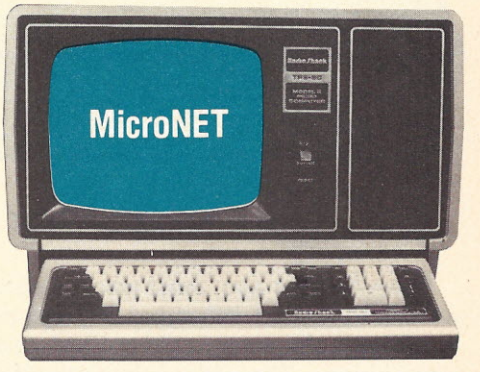

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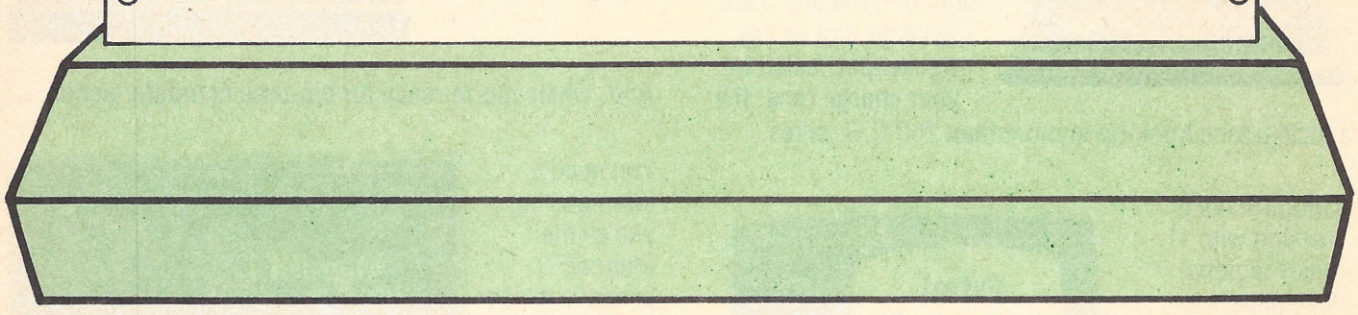
CIRCLE INQUIRY NO. 9

MicroPro's WordStar
The Ultimate Word Processor for CP/M?



by Alan R. Miller

Several years ago, most word processors for CP/M were line oriented. When one of these editors was used to delete a character, it did not just disappear from the video screen. The editor printed the deleted character a second time, perhaps between backslashes.

Some of these text editors joined adjacent lines by deletion of the carriage-return, line-feed between them; or a line could be divided by insertion of a carriage-return, line-feed pair. But it was difficult to perform other editing operations. These editors were not designed for video screens, so it was difficult to observe a local region of the edit buffer as changes were made.

MicroPro of San Rafael, CA has produced a powerful combination text editor and word processor called WordStar. The editor displays the finished document directly on the video screen. Words that don't fit at the end of a line are automatically moved down to the next. Spaces are added to justify the previous line.

An actual carriage-return, line-feed pair is placed into the text. For this reason, the resulting file can correctly be rendered by other CP/M programs. The marvelous feature of WordStar is that the carriage-return, line-feed pairs that are inserted automatically by the editor are different from those added by the user.

The Ascii character set utilizes only the low-order 7 bits of each byte. The high-order bit is not needed. MicroPro ingeniously uses this fact in its formatting logic of WordStar. The high-order bit is set (to unity) for any carriage-return, line-feed pair that is added by the editor. By contrast, the high-order bit is reset (to zero) for a carriage-return typed by the user. Thus a single paragraph that contained 8 lines, would have 7 carriage-return, line-feed pairs with the high-order bit set. But the high-order bit of the last one, which was typed by the user, would have the high-order bit reset.

A distinction between characters entered by the user and those entered automatically by the program is necessary if the paragraph is reformatted. Suppose that the initial line length was set for 70 characters. A subsequent reduction to 55 characters would necessitate a reforming of the paragraph. The carriage-return, line-feed pairs would have to be moved.

WordStar only moves those that were automatically entered. It does not change those that were entered by the user. Thus the high-order bit is used as a flag. The same distinction is made with regard to spaces.

Extra spaces added by the user are not removed, whereas extra spaces added by the editor for justification can be removed during reformatting. To make this distinction, the high-order bit is set for the final letter of each word.

A separate program called Install is executed initially and configures WordStar to video terminal and printer. Install asks several questions about your system: type of terminal, whether you have a daisywheel printer with variable character spacing and variable height, and whether the printer can backspace.

A symbolic patcher in Install allows the user to directly reference the original symbols of the assembly-language program. The appropriate listings are given so that the knowledgable user can make the desired patches. At the end of the Install operation, all options are summarized on the screen. If any are incorrect, the process can easily be repeated to make corrections.

Finally, Install asks for the desired file name to be given to the program. MicroPro suggests WS. You may choose almost any name, however, be sure that you don't change the name with the CP/M command 'ren'. Install codes your choice of name into the program itself.

Before actually using WordStar for the first time, refer to the summary of commands in Appendix I of the 100-page user manual. This page should be left open for ready reference until you become familiar with the commands. There are over 100.

For a typical installation, especially for single-density or minidisks, WordStar and its two associated overlay files, 'Wsmsgs.ovr' and 'Wsovly1.ovr', should

be on drive A. The file to be edited or created should be on drive B, the default drive. WordStar can be executed alone:

B>A:WS

or the name of the file to be edited can be included:

B>A:WS NEWFILE.DOC

For a very large file, the name of another drive can also be included:

B>A:WS NEWFILE.DOC C:

In this case, the original file will be on drive B and the second version on drive C. The next version will be on drive B. This ping-pong method allows large files to be edited.

Any command possible

If no filename was initially given, WordStar will be in the no-file state and the disk directory will be displayed. At this point, it is possible to give any command that can be given at the CP/M system level. In fact, you can execute WordStar from WordStar.

Thus a program can be deleted or renamed. The CP/M program Stat can be executed to determine the available disk space on any disk drive. The D command and a filename, however, can now be given to edit a file.

A complete small file, or a portion of a large file, is loaded into memory. The upper half of the video screen is devoted to an explanation of some of the commands. The first part of the text to be edited is displayed on the lower half of the screen. As the user learns more about the commands, less and less of the screen can be devoted to instructions, and more can be used for the display of text. This is controlled by setting the help level to a value from 0 to 3.

Text is entered by typing the desired characters. If word wrap is not disabled, the text will automatically be formatted as it is entered. Only the ends of paragraphs are especially indicated by pressing the carriage return. Text can be corrected by moving the cursor to the desired position and over-writing new text. Alternately, insert mode can be entered by pressing control-V.

All WordStar commands begin with a control character. Those beginning with a control-J, K, O, P, or Q are followed by a second letter. If only the first character of this sequence is typed, the upper portion of the screen changes to information about this type of command. On the other hand, if the user types both characters of the command, the task is executed immediately.

Two-character commands are nicely implemented in WordStar. For example, a control-Q followed by an upper- or lower-case C will move the cursor to the end of the file.

The cursor can be moved through the file in many different ways. Up, down, left and right motions are obtained, respectively, by the control-E, X, S and D keys, arranged that way on the keyboard. The E is in the top row, the X is in the bottom row, and the S and D are side by side in the middle row. Thus it is possible to keep the little finger on the control key and press these other keys with the other fingers of the left hand. Control-H, the Ascii backspace character, is used for cursor left.

Additional commands move the cursor farther than one character at a time. A control-F moves the cursor one word to the right. A control-A moves the cursor one word to the left. A control-Q followed by an E (upper or lower case) or a control-E moves the cursor to the top of the screen.

A control-Q followed by an X puts the cursor at the bottom of the screen. A control-Q, S moves the cursor to the left side of the screen. Control-Q, D moves it to the right side. Control-Z and W scroll the screen respectively up and down one line. Control-C and R scroll up and down one screenful. Control-Q, R goes to the beginning of the file; Control-Q, C goes to the end.

Global search and replace commands can be used to find a certain passage so it can be changed to something else. There are several different options associated with this command. For example, upper and lower case can be treated as the same, a repeat factor can be given, etc. Blocks of text can be especially marked. Then the marked passage can be deleted, moved, copied (replicated), or written to a disk file.

The beginning of a block is marked by typing control-K, B. The symbol <B> then appears (as a dimly-lit symbol) at the cursor position. The cursor is moved to the end of the block and a control-K, K is given. At this point, all the text in the block becomes dim or is rendered in inverse video, depending on the style of video terminal in use. The marker symbol at the beginning of the block now disappears.

If the end of the block is marked (with a control-K, K) before the beginning marker has been set, the symbol <K> appears at the block end. Since the control-K symbol is normally the regular cursor-up key (except in WordStar), the inexperienced user may find this strange symbol <K> appearing in the text, when in fact, a cursor movement was desired. The frustrating part is that <K> refuses to go away. It can't be deleted by typing control-G or 'del'. The simple solution is to type control-K, K again, and the curious symbol instantly disappears.

During the edit session, the name of the file is displayed on the top line of the screen. In addition, the page number, line number and column of the cursor position are also shown on the top line. Finally, if insert mode is turned on, the words 'insert on' also appear. Page boundaries are clearly marked by a dashed line across the screen.

New page formed

Dynamic formatting commands can be embedded directly in the file. These begin with a decimal point in column 1. For example the command:

.CP 7

stands for conditional page. When such a command is entered into the text, a new page is immediately started if less than 7 lines remain on the current page. It is very dramatic to see the page immediately move up as the command is typed.

Another useful feature is keyboard buffering. During most operations, the console status register is monitored. If the user continues to type instructions while the program is still performing a previous task, the keyboard characters are read and put into a buffer. They are not lost.

There are times, however, when WordStar can lose keyboard characters. This can occur during disk access. Therefore, the word 'wait' appears on the top of the screen at this time.

If a file is edited with any CP/M editor, the new file is given the original filename and the filetype of the

original file is changed to BAK. Thus if the file called:

CHAPTER1.TXT

is edited, there will be two files at the end of the editing session:

CHAPTER1.TXT and
CHAPTER1.BAK

If the file is edited a second time, the new file (version 3) is given the file extension of TXT and the previous file (version 2) becomes the BAK file. The first version is deleted.

If an editing session is aborted with the usual editor, there will only be one file in existence. This occurs because the original BAK file was deleted at the very beginning. WordStar, however, is different.

The BAK file is not deleted until the end of the session. Thus if the editing session is abandoned, there will still be two files. The exception to this occurs if the disk is so full that there is no room to save the new file. In this case, WordStar indicates that the backup file is being deleted to gain space. If it is still insufficient, WordStar will so inform the user. Commands can delete other unneeded files.

After a file has been created and edited, it still is not a finished document. If justification has been set, the correct number of spaces will be present. But the high-order bits are set for the last letter of each word and for most of the carriage returns and line feeds. Furthermore, page numbers and text for page headings are not present.

Additional options

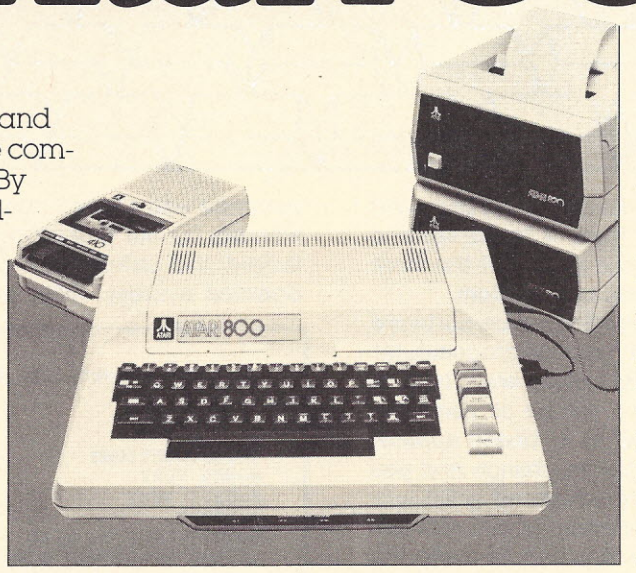
After a file is in its desired form, the print command is given. The user is then asked a series of questions. The first is whether the output should go to the printer or whether a printable disk file should be created instead. Another option is whether formfeed characters should be used to indicate the end of each page or whether the corresponding number of line feeds should be used instead.

Nondocument files, such as source programs for Basic, Pascal and assembly language, require a different type of editor. Word wrap and right-margin justification are not desired. On the other hand, vertical alignment of the information may be very important. For this reason, editors which are designed for ordinary text are not generally suitable for this application. WordStar, however, has a nondocument mode. In this configuration, it performs intelligently. High-order bits used to set microspace justification under the document mode, are not used. Thus, the resulting file is fully compatible with compilers and assemblers.

WordStar works best with a hard disk because it is faster than a floppy disk, and with a memory-mapped video screen which is faster than a serial terminal. For the usual floppy disk and serial video terminal, however, Word-Master editor will perform much faster, and therefore will usually be preferred for nondocument files.

With version 1.06 Word-Master, you will find the switch to WordStar disconcerting. Most of the commands are different. MicroPro has issued version 1.07 in which keyboard commands have been changed to conform as closely as possible to WordStar. If you are going to switch between the two editors, you will definitely want to get this new version. □

We know the Atari 800.



The experts at ComputerLand would like you to meet the computer that leads two lives. By day, the Atari 800 is a hard-working business tool. By night, it's a stimulating educator and fascinating entertainer.

On the job, the Atari 800 is a management tool. It can help you plan and control by providing timely reports on accounts payable and receivable, inventory control, and a wide array of other business and financial management functions.

At home, it can teach more than 15 separate subjects, from Accounting and Algebra to U.S. History. It's a video blackboard that teaches, asks questions, then tells you if you have the right answers, so you learn at your own pace. It can also turn your TV set into a playground for some of the most challenging and enjoyable computer games you've ever played. And help run your household—manage your budget, balance the checkbook, keep tax records, analyze investments, even organize your recipe file.

The Atari 800 is the heart of a whole family of computer peripheral equipment and accessories including Atari's unique plug-in Memory Modules. So it can grow as your needs and interests grow. It's fully programmable and comes equipped with the Atari 800 Basic Language Cartridge. But with all its sophistication, the Atari 800 is simple, even for people who have never used a computer before.

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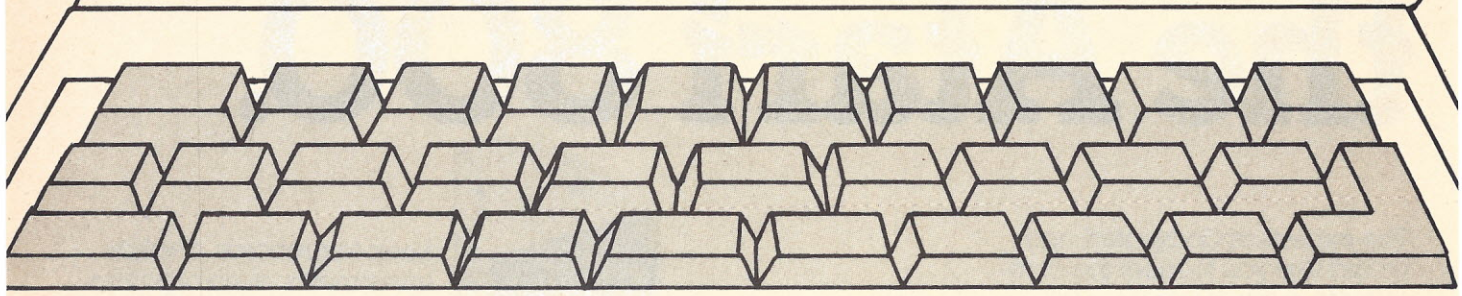
Textwriter: A Text Editing, Storing, and Printing Program

by Bill Richter



If you have a microcomputer, Basic interpreter, and printer, and are not using some form of textwriter and storing program, you are losing out on one of the most useful applications of a microcomputer system.

Why wait until the price of those $125-plus software packages come down or until your microcomputer budget can afford one. Try this simple and straightforward textwriter; chances are it will be all you need for most of your personal as well as business applications. In the event your requirements change and you need all the sophistication of the advanced word processors, all is not lost. The experience gained with this program will put you in a better position to make the right selection.

My requirements were simple. I needed something to edit text on a CRT for letter writing and documenting our 2650 S-100 computer boards. Additionally I needed some easy method to store the text on disk for future editing and printing. I did not want to use "funny" control characters, the escape key, or letters in the editing process that do not show up in the final text. Only the four cursor control arrows, line feed and carriage return keys are used in the text entry and editing operation.

Simply stated, what you see is what you get. The cursor may be moved around anywhere on the screen, and at any time during entry or editing process. When the repeat key is used along with the arrow keys, the cursor can be darted around the screen quickly for immediate error correction.

Using this program requires no computer experience or knowledge of disk operating system DOS procedures. All functions are on the operator level. Questions are asked on critical disk operations to prevent operator errors and the inadvertent destruction of critical documents. All illegal entries are checked to make sure there are no accidental alterations or loss of text. It is impossible to get the cursor out of bounds or out of sync with respect to the actual text buffer. All illegal operations are prevented and flaged with audible bell character. The program has performed flawlessly and has been in continuous daily service in our business for almost a year.

My first attempt at this program was written in assembly language. This was an unforgettable experience and caused considerable delays in preparing manuals for our first product. The program worked, but lacked the safety and convenience of an operator-oriented system. After enduring many painful occurrances of lost files, garbled and disappearing text, I finally decided to switch to a Basic interpreter with string handling capabilities.

```
TEXTWRITER  VER 3.1  VICTORIA MICRO DIGITAL

OPTION LIST

I=INSTRUCTIONS
N=NEW TEXT
E=EDIT TEXT
P=PRINT
S=SAVE TEXT ON DISK
L=LOAD TEXT FROM DISK
D=DESTROY FILE ON DISK
O=OPTION LIST
B=RETURN TO BASIC

TYPE OPTION LETTER AND RETURN.....N
ENTER LINE LENGTH.....70
ENTER PAGE LENGTH.....55

PLEASE WAIT FOR SCREEN TO CLEAR


     Now that the screen has cleared, I will
type this example of a NEW entry.  The input
is free format; ues it just like a typewriter.
There is no need to type line feed after a
carriage return; the program takes care of it.

     I will now terminate the text entry and
return to the option query by pushing the
CONTROL key and typing the LETTER O.



TYPE OPTION LETTER AND RETURN.....S
ENTER UP TO 8 CHAR FILE NAME....XAMPL
IS THIS A EXISTING FILE? (Y/N)...N
SAVE COMPLETE

TYPE OPTION LETTER AND RETURN.....
```

Example 1. Initialization, new entry, and save in file name 'xampl'.

A North Star Horizon II and Lear Siegler ADM-3 CRT were selected for the system. My decision was based

on what I felt was mature hardware, and really a super DOS and Basic interpreter. I have found nothing against a CP/M-based system except that I found the documentation confusing and difficult to use. Actually the new North Star documentation, Soft-Doc 2.1, is really what sold me; it's gotten all together in one easy-reading manual.

Although this program was written in North Star Basic, there should be no problem converting it to other dialects. Only the most common basic statements are used. The only differences may be in disk file statements, error traps, and string operations. String statements such as line 1100 E$(X,X) = T$ may read MID(X,1) = T$ in some Basics. 'Errset' error trap statements are unique to North Star and will need to be converted or removed if your interpreter does not have

```
TYPE OPTION LETTER AND RETURN.....L
ENTER FILE NAME....OLDTEXT
LOAD COMPLETE

TYPE OPTION LETTER AND RETURN.....E


     This is some old text that was stored as
another example.  Note that you had to use
the EDIT option to display it on this screen.
You could have decided to skip the EDIT and
just PRINT it.  If this were a form letter,
you would change the date,name, and address
and then PRINT it.

     Just like after the NEW option, we are
in the EDIT mode and must exit with CONTROL O



TYPE OPTION LETTER AND RETURN.....
```

Example 2. Loading an existing file called 'oldtext' (Note that these hard copy examples of a CRT screens do not clearly show how screen clears—the screen is always cleared upon entering 'edit' mode.)

this feature. If eliminated, errors will cause the interpreter to stop and print an error message; if this happens you will need to carefully warmstart (reenter) Basic so that the text is not lost.

All disk calls are of the common sequential type. However, the syntax needs to be carefully compared. Some other minor differences may be as follows:

! is shorthand for 'print'

\ (back-slash) is equal to : (colon) in multiple statement lines

, (comma) is equal to ; (semi-colon)

Two more comments about strings: North Star does not require explicit dimensioning of strings of ten characters or less; your Basic might. Strings must also be able to be dimensioned to the full size of the text buffer; some Basics are limited to 256 characters.

All editing and cursor controls are done at the Basic level rather than using the North Star line editor. Line 960 'T$ = inchar$(0)' gets each keystroke and places it into the one character string T$. This feature eliminates the peculiarities of the North Star system and allows the editing to run fully under Basic interpreter control.

A unique feature is used to indicate the position of the CRT screen display in relation to the printed page image in memory. Whenever the text starts to scroll off the top of the screen, the cursor is moved to the top left of the screen and status is printed as follows:

BOTTOM LINE = 25 LINES REMAINING = 35

This example shows a 60 line text page that was specified by the operator at the start of the operation. Each carriage return updates the status line. If your CRT's cursor is not addressable, eliminate lines 1290, 1300, and 1310.

As stated earlier, the CRT used in this program is the Lear Siegler ADM-3, however almost any CRT can be used. Memory mapped devices can also be added if the driver software emulates a scrolling-type CRT.

For all practical text editing, you should use a 24 by 80 character device. In the event that you use a display other than 24 by 80, you will need to change line 50 T = 24 where T is equal to the number of characters per line.

This is set up for a maximum page size of 79 characters wide by 66 lines. It is somewhat large for a typed page, but it does fit on a standard 8½ by 11 sheet. When the program starts, it asks the operator for the page size. This allows the program to size the text buffer and eventually create a correctly sized disk file. If multiple pages are to be saved on the disk, each must be saved a page at a time, thus there will be a file name for each page.

There may be some instances when you will want to change the line limit. For example: You might want to create very long pages to be used as a mailing list. To do this, change the 66 line limit in line 80 and line 780.

There are special control characters on the ADM-3 CRT. Change these lines if your control characters differ.

LINE 60 CHR$(26) = CLEAR SCREEN AND HOME
LINE 1290 CHR$(30) = HOME CURSOR (top left)
LINE 1310 CHR$(27),CHR$(61),CHR$(55), CHR$(32)
escape = y x
ADM-3 sequence to restore cursor
to bottom left of screen.
LINE 1370 CHR$(12) = RIGHT CURSOR
LINE 1440 CHR$(8) = LEFT CURSOR
LINE 1510 CHR$(11) = UP CURSOR
LINE 1590 CHR$(10) = DOWN CURSOR

There are two basic modes of operation: 'edit' and 'command'. During 'edit', none of the control'commands' are callable. To exit the 'edit' mode, hold the control key and push the letter O (for option list). After the option list is displayed, you are asked to make one of the following 'command' selections:

I = INSTRUCTIONS

Which gives a simplified user oriented explanation of each command.

N = NEW TEXT ENTRY

This command initializes the memory text buffer with spaces (blanks), clears the screen, positions the cursor to the top left (home), and enters the 'edit' mode. This takes about 5 seconds, after which 'please wait for screen to clear' is printed. Text may now be entered in free format.

S = SAVE TEXT ON DISK

The operator is asked to enter a file name with a maximum of eight characters. If the file is to be on the

```
TYPE OPTION LETTER AND RETURN.....A

TYPE OPTION LETTER AND RETURN.....3

TYPE OPTION LETTER AND RETURN.....L
ENTER FILE NAME....ERTEXT
ENTER FILE NAME....ERRTEX
ENTER FILE NAME....ERRTEXT
LOAD COMPLETE

TYPE OPTION LETTER AND RETURN.....E


     This example text was stored with the
file name of ERRTEXT.  This text describes the
above errors.

     The first two errors were illegal option
selections.  The next errors show illegal or
non-existant file names.  The program keeps
asking until it gets a good entry.

     Finally the correct file name, ERRTEXT
was used and the LOAD COMPLETE is displayed.
Now this test is displayed with the EDIT
command.


TYPE OPTION LETTER AND RETURN.....
```

Example 3. Error recovery examples. The North Star 'errset' instructions are used to keep the program from exiting back to Basic's ready.

second drive, the file name must be suffixed with a comma and the number 2. Also a question is asked to find out if the specified file name is an existing or old file. If a new file is specified, a create is done with the dimensions specified in the N command. If there is an illegal entry or a nonexistent file defined, the Basic 'errset' command traps the error and causes the program to ask for the file name again. After the disk write (about 3 seconds), a confirmation message is printed and the operator is asked for the next command.

L = LOAD TEXT FROM DISK

This is similar to 'save' in that it asks the operator for the disk file name. Illegal operations are trapped and the request for a file name is repeated until a correct or existing file is specified.

After the disk read is completed, a load complete message is printed. The read takes about one second, once the disks are up to speed. Like most other commands, this one also asks for the next command entry. The next most likely will be 'edit' or 'print'.

E = EDIT COMMAND

The CRT screen is filled with the top 24 lines of the current text buffer, which most likely will be the file just loaded. The 'edit' mode is entered and the text may now be altered or reviewed. To examine the lower part of the page, just hold the repeat carriage return key; the text will quickly scroll up from the bottom. If you make your corrections and like what you see, you may either restore the text onto disk with 'save' or just 'print'. Use the 'control O' to exit 'edit' mode.

P = PRINT COMMAND

The current text buffer is printed on device #1. If, after print out, you decide you want another copy, just type the letter P. If your printer device is not assigned to device #1, you will want to make a change at line 1720, where the #1 indicates the device number one.

D = DESTROY A DISK FILE

This command is used to purge obsolete text files from the disk. After the operator enters the file name, the computer replies 'do you really want to destroy (filename)'. This is your last chance to carefully look at the file name and make sure you really have the right one before pushing the return key.

O = OPTION LIST

prints the 'command' list, in case you have forgotten the options available.

B = RETURN TO BASIC

is a convenient way to get back to Basic interpreter 'ready'. You should eliminate this option if you are building a turnkey system for nonprogrammer-type operators.

The ease and speed in which the text files may be accessed makes the program useful for many other things besides saving copies of letters. How about storing things like vacation check lists, telephone lists, mailing lists, household and automobile PM check lists, important dates, family trees, family and financial records, recipes, etc.? It is a simple matter to make a change or quickly print a copy of your text material.

For business, the applications are similar. The obvious one is saving form letters; just do a 'load', add name, and 'print'. We store blank images of our invoices and statements on disk and simply call them up on the screen and fill in the blanks. All of our documentation masters, price lists, and financial data are stored on disk files in the form of letter pages.

There are many other programs that access the disk files created by Textwriter. However, they are not within the scope of this article. Basically they are highly specialized and are custom designed for each specific

```
TYPE OPTION LETTER AND RETURN.....D
ENTER UP TO 8 CHAR FILE NAME....OLDTEXT
DO YOU REALLY WANT TO DESTROY   OLDTEXT?  (Y/N)...Y
YOU HAVE DESTROYED OLDTEXT

TYPE OPTION LETTER AND RETURN.....
```

Example 4. Purging old text from disk files. Note the double check feature.

application. They greatly expand the capability of this program into much more than a textwriter.

In effect what we have is the beginning of a simple data base that can steadily grow. You may want to write a few of your own programs that access randomly into the disk files. For example, we have developed interactive programs that ask questions and fill in the blanks on our invoice and statement disk files. We have another program that similarly accesses our general ledger and checks, register files and then does the arithmetic.

As stated earlier, this program is not a full featured word processor, but it serves its purpose well. Use it like it is, or study the methods used herein and expand the program to suit your custom needs. □

Program on page 156

The book you've been waiting for...

Ever since Radio Shack sold the first TRS-80 Model I users have been searching for detailed information about its inner workings that Tandy would not, or could not, make available. In particular the Level II BASIC from Microsoft contains dozens of subroutines that can be tremendously useful to any programmer, but Tandy Corporation is probably under contractual obligation to Microsoft not to supply information (if they even have it!).

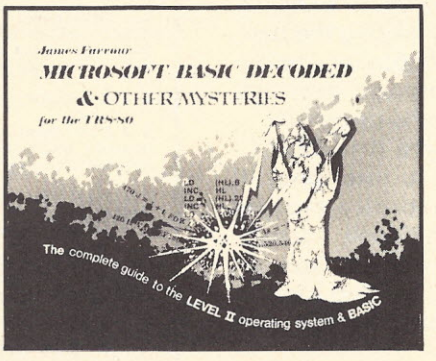
Dedicated users, proficient in assembly language, have disassembled the Level II ROMs and made their own comments. But the majority of users are left in with virtually no information, apart from occasional articles and whatever they can decipher on their own.

ENTERPRISING USERS - Several of the more enterprising programmers realized that if they published their own comments a lot of TRS-80 users would buy them. The BOOK, Disassembled Handbook and Supermap are some of the available books giving comments on the ROM set - but they all suffer from serious drawbacks, being either incomplete, unintelligible or even worse - inaccurate!

Incomplete books are usually published when the author has not finished understanding what he's writing about. Hence the "continued next book" lines in some publications, translated into english read "buy another book when I've done some more work". Unintelligible books are due to poor editing, or no editing at all! Inaccurate information is a result of not checking with anyone else.

Microsoft BASIC Decoded & Other Mysteries is both complete and understandable. Nearly 7,000 lines of comments for the Level II ROMs, with an additional 6 chapters of useful information, make this the biggest and best book available on the subject.

Written by James Farvour, the comment section took more than a year to finish - it even includes the changes for the latest ROM set in an appendix. Edited by Jim Perry, until recently managing editor of 80 Microcomputing, the text and comments are understandable.



Complete & Understandable - IJG, publishers of TRS-80 Disk & Other Mysteries, could have published an incomplete or unintelligible book on the ROMs - but chose to wait and do it properly.

Tested examples are given for virtually every ROM subroutine, showing you how to CALL them from BASIC or use them in an assembly language program. With more than 300 pages Microsoft BASIC Decoded & Other Mysteries is by far the largest book about Level II available.

Copyright - In order to respect Microsoft copyright the actual disassembled code is not printed, but the book is designed to come apart and fit into a standard 3 ring binder with your own disassembly (all pages are pre-drilled).

In short, Microsoft BASIC Decoded & Other Mysteries, is the most complete, understandable and accurate guide to your Level II ROMs that is available - bar none!

Pick one up at your nearest IJG dealer, phone your order in or use the coupon - satisfaction guaranteed.

FOR TRS-80 USERS

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* T.M. Microsoft † T.M. Tandy Corp.

Buying a Computer by R.F.P.

by David E. Cortesi

How does one go about buying a computer? There are so many magazines, so many advertisements, so many dealers, each assuring us that this machine, board, language or word processor is just what we need. Other products—the automobile, the camera—offer as many bewildering choices, but at least we set out to buy them with a solid base of first-person experience.

I entered the retail computer market as a professional, in need of a system to support my work as a writer and programmer. I'd spent many years with computers, knew their limitations, knew the difficulties of bringing up the simplest of systems. I had been reading the personal computer press since the first hobbyist articles of 1975, so I had some grasp of the product lines and their merits. Yet, I was still confused and uncertain!

After all, I was planning to spend more than $5,000 on a professional tool—not a decision to take lightly. I considered the idea of trying to home-brew a system from mail-order components, but didn't know enough to ensure quick success. Therefore, I would have to pay someone else to build it. How was I to find a trustworthy dealer to configure the system I wanted and then support it afterward?

I decided to find a vendor using a method common in the big-computer marketplace as well as in other fields: request for proposal (RFP). Sometimes called a request for quote or request for bid, an RFP is a document that a buyer prepares, describing what he wants to buy. It is mailed to a number of potential vendors; they respond with a statement of what they have to sell that fits the buyer's needs. This provides input from a number of vendors at the least expense of time. It also benefits the vendor by carrying an implicit commitment that the buyer is serious: he has money and the intent to purchase. A person who is just shopping would issue a request for information, but the issuer of an RFP means to close a deal. This implicit commitment is what makes the RFP valuable to a vendor.

I spent many hours getting the wording of my RFP just right (figure 1). I worded it carefully so that it was explicit on the points I cared about. Other matters were left open for the vendor to choose, based on his experience and stock on hand. It was important to get as many responses as possible, so I labored to make the document short and to the point. I figured that a small-time vendor with limited staff might not have the patience to wade through a long exposition of my needs and opinions.

That same consideration prompted me to include a simple questionnaire (figure 2) on which the vendor could list his prices, any discounts and add it up. I imagined that a vendor who knew his products ought to be able to read and assimilate the RFP in 20 minutes, and be able to look up the prices and mail the questionnaire in another hour at most.

SYSTEM SPECIFICATIONS

1. Overview

The system is to be an S-100 machine with a Z-80 processor, 64K of memory, and 500K to 1000K bytes of flexible-disk storage. The basic software will be CP/M 2.x, with compilers for BASIC and Pascal, and a text-processor.

The system must support two peripherals already purchased: a Heath H-19 video terminal and a Xerox 1750 (Diablo 1650) printer. The system will be integrated and configured to the peripherals by the vendor, and demonstrated prior to acceptance.

2. Detailed Specifications -- Hardware

2.1 Mainframe: an S-100 motherboard and cardcage, with power supply and cooling fan in a table-top cabinet. No front panel controls are required. At least 4 card slots should remain uncommitted after the system is assembled.

2.2 Processor: a Z80 CPU card operating at 4MHZ.

2.3 Programmable storage: 64K of static storage. Specify how much contiguous storage is available to user-written programs.

2.4 Disk storage: at least two eight-inch drives, with capacity of 500 to 1000KB when formatted by CP/M, and with a controller capable of supporting four drives.

2.5 I/O Ports: capacity to drive two existing RS-232 devices (the H-19 at 9600 baud; the 1650 at 300), plus at least one more RS-232 port with selectable speeds.

3. Detailed Specifications -- Software

3.1 Operating system: CP/M 2.x with BIOS configured to the system hardware.

3.2 BASIC compiler: Microsoft BASIC-80 package including Macro-80, Link-80.

3.3 Pascal compiler: Pascal/Z from InterSystems.

3.4 Editor and text formatter: The Magic Wand from Small Business Applications, Inc.

4. Integration and Configuration

The various components of the system must be brought together and integrated into a whole, including configuring the software packages to work with the existing peripherals. This work should be done by the vendor, on the vendor's premises. The integrated system will be demonstrated to work, including exercising all software components, before the system is accepted and final payment made.

5. Maintenance

Over and above the initial warranties on the individual components, some kind of maintenance assurance is required to cover the whole hardware assembly for an extended period. Specify what kind of maintenance contract or policy would cover the proposed system, where the maintenance would be done, by whom, and what it would cost.

Figure 1. RFP sample copy

The cover letter (figure 3) took almost as long to compose as the rest of the document. It was as

businesslike and professional as I could make it. It made the RFP commitment explicit and stated the points I'd use to evaluate the bids, so that the vendors would know what to emphasize in their responses.

I collected the addresses of 20 likely vendors from the yellow pages and magazine ads. I ran off 20 originals and sent them out. Nothing happened. With one discouraging exception, two weeks passed with no response whatever. My education in the state of the computer retail market had begun.

The exception was a telephone call from a computer store, one of a national franchise chain. The employee introduced himself as "Jeff" and we engaged in one of the most irritating conversations I've ever had. Jeff told me that it would take "about three hours" to fill in my questionnaire, and they "don't usually spend that much time on shoppers, as we call them." He explained that most of their customers "come into the store and tell us what they want to do, and we show them what they ought to have and they take it, or don't." I almost felt like apologizing for knowing my own mind, but just said that I was going to carry on with the RFP. If he'd fill out the form and shoot it back, I would look at it very carefully.

Jeff didn't want to do that. Instead he came up with a really staggering offer. After the other responses came in (he doubted that there would be any), I was to bring them to the store and he would look them over. "Where the prices are right, we'll say so, and where they're not, we'll tell you why." I explained through clenched teeth that if any other vendors responded in good faith, I damn well wouldn't give him a chance to second-guess their prices, and we hung up.

I was rocked by this. Was the RFP completely unknown in this market? And was the level of business ethics that low generally, or had I just hit one isolated

QUESTIONNAIRE

Use this form to describe the make and model of the hardware, and for all components the list price and your quoted price (where different). Feel free to use a different format, or additional pages, or to include manufacturer's literature, but do supply the information requested.

	list	quote
Mainframe _____		
_____	$_____	$_____
CPU card _____	$_____	$_____
Memory card(s) ____ each at $_____		
_____	$_____	$_____
Disk Subsystem _____		
_____	$_____	$_____
I/O card(s) _____		
_____	$_____	$_____
CP/M 2.0	$_____	$_____
BASIC-80	$_____	$_____
Pascal/Z	$_____	$_____
Magic Wand	$_____	$_____

total . . . . . .$_____
less system discount (if any). . . . .-_____
discounted net _____
plus California sales tax +_____
plus integration charge +_____
total system price . . . . . .$_____

Figure 2. RFP questionnaire

9 June, 1980

The Flipped Bit Computer Store
2048 Chip Road
Sunnyvale, California

Gentlemen,

I require a small computer system for word processing and general programming. I will select a vendor for this system from among those who provide a written response to the questionnaire enclosed.

In selecting a vendor I will look primarily at four things: total price; ability to configure and demonstrate a complete system; ability to provide maintenance service; and proximity to my home in Palo Alto.

Call me at 415- - if you have any questions. I look forward to seeing your response.

David E. Cortesi
2340 Tasso St.
Palo Alto, CA 94301

Figure 3. Sample cover letter

turkey? When no other responses came in, things began to look bleak.

In the third week I began to make follow-up phone calls. It took several hours over two days to complete all 19 calls. Then I took stock.

One store was out of business.

Three stores couldn't recall the letter but said that they would look for it and call back; they never did. I decided that an organization that didn't return business calls probably wouldn't return trouble calls either, so I scratched them.

Seven vendors remembered the letter but weren't interested in bidding, mostly because they didn't handle S-100 products. When I asked why they hadn't responded in any way, by mail or phone, one said "Oh, we never respond to requests we can't fill."

Five stores couldn't recall the letter and couldn't find it (one because "it's apparently in the briefcase of a fellow who's no longer with us"), but said they would like to bid and would I please send another copy? So I made up five more copies and sent them out.

One store apologized that "it's been working its way up our mail stack; our S-100 guy just saw it three days ago." The S-100 guy called back and promised to send a response when he got time.

At another store, a sales person said he hadn't planned to respond because "that's a pretty scary-looking letter, you know. Like you had been burned before and weren't about to be again." My highly professional tone had backfired! I had meant to project the image of a no-nonsense customer with a rock-solid credit rating; instead I had left someone at a loss as to how to address such an ogre. I persuaded him that I wasn't dangerous, and he promised to respond.

The last store couldn't offer a maintenance policy on a customized system and so didn't think they could respond. I assured them that *nobody* seemed to offer a maintenance policy on *anything*, and they promised to respond with what they had.

One encouraging fact emerged from all these calls: nearly everyone I spoke to was familiar with the idea of an RFP, although not always by that name. On the other hand, it was discouraging to discover the prevalence of sloppy business practices—lost mail, unanswered mail, failure to return calls—in the computer trade. I continued to find this throughout my quest. It is a sign of the immaturity of the field, and any professional coming to this market will just have to deal with it.

Two additional steps

I had made mistakes as well. I had wasted nearly half my efforts on vendors that didn't carry what I wanted. In hindsight it was clear that I should have made preliminary calls to all the vendors before mailing the RFP. That would have eliminated the ineligible ones, and gotten me specific names of people to address in my cover letters.

My technical specifications were causing trouble too. The system I asked for resembled a Cromemco or Dynabyte in capacity, but the combination of features I required, with the fact that I didn't need a terminal or printer, worked to eliminate all the standard packages on the market. I wasn't surprised at that. I was surprised to discover that most vendors had as little interest in custom-tailoring a system as I did. It was understandable when I thought about it, but it shrank the list of vendors drastically.

I pursued the vendors for the next four weeks. Two more were added to the list; many dropped off it. I made dozens of phone calls. A typical sequence ensued with that store whose employee found my cover letter so frightening. Ten days after the first follow-up call, he called back to question a point in the specifications (the only store to do so). We had a cordial conversation, ending with the salesman's promise to "have this out by tonight."

Fifteen days later I called to find out why nothing had come in the mail. A different person said he thought "it came up in a sales meeting and we weren't going to bid," but he would check it out and call back. He didn't, so I called again the next day, reaching yet a different person. After discussing (for the third time) how I really didn't want a Cromemco because of its price and use of dynamic storage, it became clear that they really weren't interested in selling custom systems but couldn't bring themselves to say so. I told them to forget it and they seemed relieved to do so.

Twenty-two vendors saw the RFP. Of that number, seven didn't handle such products. Four of the remaining fifteen sent written responses. Two of those didn't match the specifications. However, the remaining two vendors did sell the kind of system I asked for, were willing to build to my specifications and offered similar, reasonable prices. The RFP process had worked.

I visited both stores and spoke long with their technical people. One store seemed to have more experience and a better ability to configure and demonstrate a complete system as I had specified.

Purchasing by RFP cost me more hours work than I had expected, but still consumed less time and expense than I would have spent making personal visits to all 22 stores or just to the 15 real possibilities.

Here are my suggestions for anyone else who wants to purchase a small computer by RFP.

Be aware when you draw up your specifications that, if they don't match the current engineering practice in packaged systems, your list of vendors will be very short. If you genuinely disagree with the current practice, as I disagree with the use of 5-in disk drives and dynamic storage, you had better start with a long list. If you have no problem with a standard system design, be careful not to write over-detailed specifications that might exclude a vendor by accident.

Sharing the blame

Make a telephone survey of every vendor on your initial list. This will eliminate the ones whose ad in the yellow pages seems to offer everything but which, in fact, handle only a small range of products.

During the telephone survey, take pains to get the name of the person to whom you can address the RFP. Put that name in the salutation of the cover letter. I believe this closer degree of human contact will ensure faster responses.

Finally, if you want negative acknowledgements as well as positive responses—and how else can you keep track of the status of a long list of vendors?—you will probably have to go two steps further than I did. If I were doing it again, I would enclose a stamped, self-addressed envelope with the RFP, and I would add a line like this to the questionnaire:

SORRY, DECLINE TO BID BECAUSE _____.

I believe that the RFP, handled this way, is an excellent way of purchasing professional-calibre systems. Even as I mis-handled it, it served to connect me with the right vendors. Properly done, it should get buyers and sellers paired up well while saving the time of both. □

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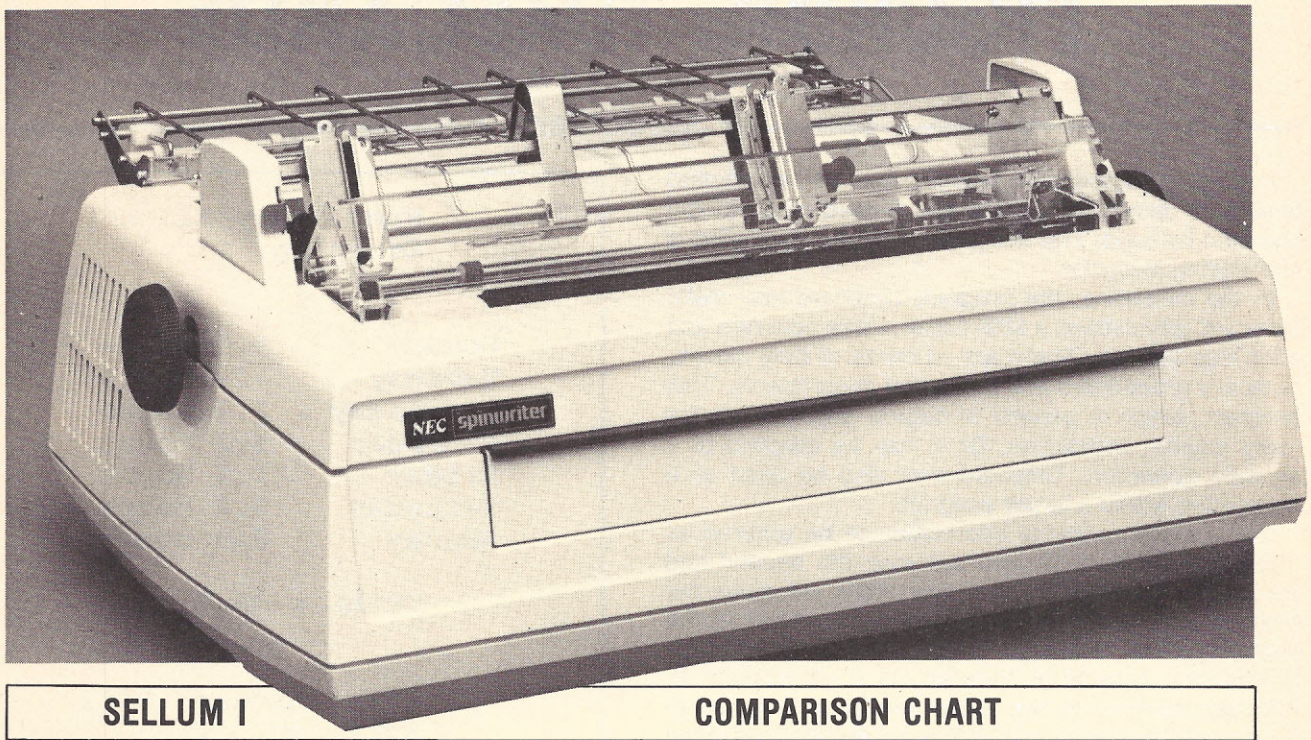

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Centronics Parallel			✓	✓
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Baud Rate	Max. 1200	Max. 1200	Max. 1200	50-19,200 (16)
Buffer Size	256 char.	256 char.	256 char.	650 char. Option 16K
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Select. Filtering Non-Standard Control Char.				✓
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PROGRAM FOR FIGURING TIMECARDS

by Jim Schreier

Even with automated payroll systems, computing timecards must be calculated, totaled and double checked by hand. The computer-readable time card is still waiting invention.

In the meantime, the program Timecard may make timecard calculations a little faster, more accurate and a lot less tedious. There are all types of time clocks, company procedures and personnel departments. This program, which is general in nature, should work for many smaller companies. Or it may be adapted to a specific operation. Timecard may also be used as a subroutine within a larger program.

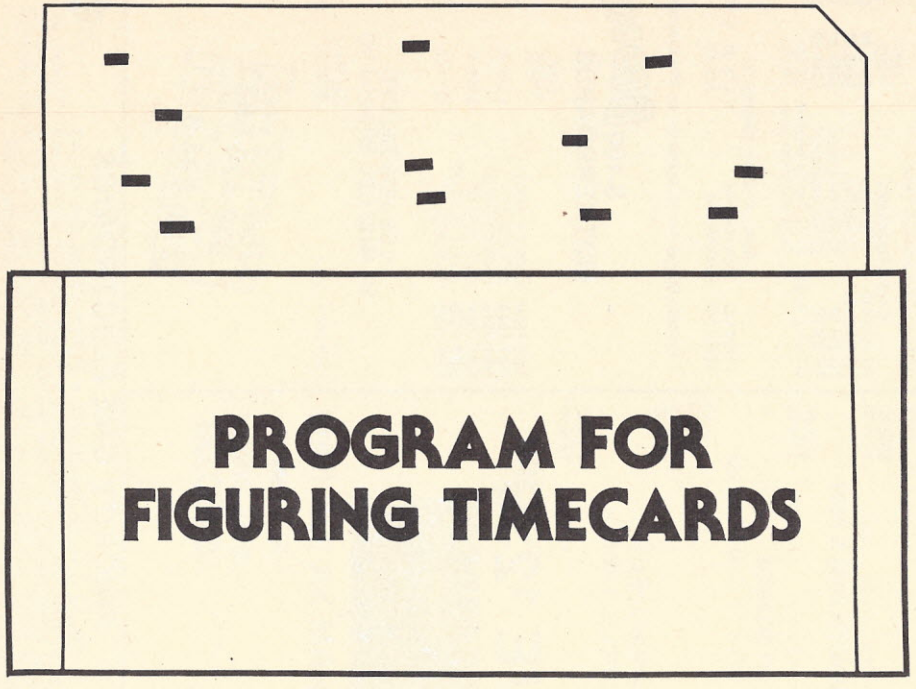
The program expects information to be entered as three digits with a decimal between the second and third digits (15.9). More than four digits will cause the time prompt to be reissued. The hour format is the common 24-hr "military" time system. The last digit represents units of 6 minutes each, 0 through 9. Although experience has shown the 24-hr time format to be best, timecards must still be figured by hand going backwards from the final punch-out of the day towards the original punch-in time. Although this method is straightforward, it can be confusing to payroll clerks.

The program requires four time prompts: punch-in, punch-out for lunch, punch-in from lunch and punch-out. Each weekday, Monday through Sunday, is requested. A 0 given for the punch-in prompt skips that day and moves on to the next. A 0 for the punch-out for lunch prompt means no lunch period was taken, and the program advances to the punch-out prompt.

At the end of the 7-day cycle, the individual's name and sequence number are printed out, followed by the hours worked each day and total hours worked for the week. The program halts so the information may be recorded on the timecard or other document, and when ready, returns for the next timecard. When all timecards have been entered, the word 'stop', issued in response to the name prompt, will cause all the entered hours to be totaled. This figure may be used as a control figure, if necessary.

Besides your computer and terminal, a cassette system and optional printer are needed. The program does not use disk files but, of course, may be altered to write all timecard data. Depending on the number of timecards, (the program is set for 50, line 70) only a medium amount of memory is needed (less than 3000 bytes). The program is written using Technical Systems Consultant's extended disk Basic (XBasic). Any Basic with string capabilities will operate. CHR$(12) clears the CRT and will home-up the cursor. This statement should be altered as necessary. The print-using format is optional and may be removed if desired. Leave out the PU$ = "##.#", (line 90) and the term 'using', (lines 590 and 650). □

```
Name: Mary Ellen
Entry no.  1

Monday       8.0 hours
Tuesday      7.9 hours
Wednesday    8.3 hours
Thursday     8.2 hours
Friday       7.5 hours
Saturday     0.0 hours
Sunday       0.0 hours

    TOTAL = 39.9

Name: Michael Hill
Entry no.  2

Monday       8.5 hours
Tuesday      8.5 hours
Wednesday    8.9 hours
Thursday     8.4 hours
Friday       8.1 hours
Saturday     0.0 hours
Sunday       0.0 hours

    TOTAL = 42.4

Name: Sally Williams
Entry no.  3

Monday       0.0 hours
Tuesday      0.0 hours
Wednesday    0.0 hours
Thursday     0.0 hours
Friday        0.0 hours
Saturday     9.7 hours
Sunday       8.8 hours

    TOTAL = 18.5

Total Hours =  100.8

Time Card Information
```



PROGRAM FOR FIGURING TIMECARDS

```
10 REM TIMECARD.BAS
20 REM Clear CRT and Home Up Cursor
30 PRINT CHR$(12):PRINT
40 PRINT TAB(23);"TIME-CARD CACULATION"
50 AM=0:FL=0
60 PRINT:PRINT
70 DIM NM$(50),HR(50)
80 DIM X(7),DT$(7)
90 PU$="##.#"
100 INPUT "Terminal  or Printer",Z$
110 IF LEFT$(Z$,1)="P" THEN OPEN "0.PRINT" AS 0:FL=1
120 IF LEFT$(Z$,1)="p  THEN OPEN "0.PRINT" AS 0:FL=1
130 PRINT TAB(4);'To Conclude Enter "STOP"'
140 PRINT TAB(7);"Enter Employee Name";
150 AM=AM+1
160 INPUT NM$(AM)
170 IF NM$(AM)="STOP" THEN 720 ELSE 180
180 IF NM$(AM)="stop" THEN 720
190 PRINT CHR$(12):PRINT
200 PRINT TAB(4);"Time Data: ";NM$(AM)
210 PRINT TAB(7);"Entry Number";AM
220 RESTORE:PRINT
230 REM Enter Hours in 24 hr System; Minute in 10ths.
240 PRINT TAB(4);'Enter Time As: "hh.m"':PRINT
250 FOR X9=1 TO 7
260 READ DA$
270 DT$(X9)=DA$
280 PRINT TAB(5);"=== ";DA$;" ===":PRINT
290 INPUT "Time-in",A4$
300 IF LEN(A4$)>4 THEN 290
310 B4$=LEFT$(A4$,2):B4=VAL(B4$)
320 IF B4=0 THEN PRINT:GOTO 470
330 A4=VAL(A4$)
340 INPUT "Time-out for lunch",A3$
350 IF LEN(A3$)>4 THEN 340
360 B3$=LEFT$(A3$,2):B3=VAL(B3$)
370 IF B3=0 THEN 420
380 A3=VAL(A3$)
390 INPUT "Time-in from lunch",A2$
400 IF LEN(A2$)>4 THEN 390
410 A2=VAL(A2$)
420 INPUT "Time-out",A1$
430 IF LEN(A1$)>4 THEN 420
440 A1=VAL(A1$)
450 PRINT
460 X(X9)=(A1-A2)+(A3-A4)
470 NEXT X9
480 IF FL=1 THEN 490 ELSE 520
490 PRINT #0:PRINT #0
500 PRINT #0,TAB(20);"Time Card Information"
510 FL=0
520 REM display entry and hours
530 PRINT #0:PRINT #0
540 PRINT CHR$(12):PRINT
550 PRINT #0,TAB(4);"Name: ";NM$(AM)
560 PRINT #0,TAB(4);"Entry no. ";AM
570 PRINT #0:PRINT #0
580 FOR X9=1 TO 7
590 PRINT #0,DT$(X9);TAB(11);:PRINT #0,USING PU$,X(X9);
600 PRINT #0," hours"
610 TH=TH+X(X9)
620 NEXT X9
630 PRINT #0
640 PRINT #0,TAB(4);"TOTAL = ";
650 PRINT #0, USING PU$, TH
660 AB=AB+TH
670 PRINT:INPUT "Hit Any Key to Continue",XZ$
680 REM Clear the variables for next run
690 FOR X9=1 TO 7:X(X9)=0:NEXT X9:TH=0
700  PRINT CHR$(12):PRINT
710 GOTO 130
720 PRINT #0:PRINT #0
730 PRINT #0,"Total Hours = ";AB
740 CLOSE 0
750 END
760 DATA Monday,Tuesday,Wednesday,Thursday,Friday,Saturday,Sunday
```

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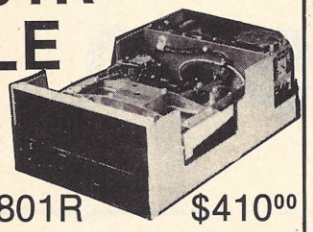

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Per Track	26.6 kilobits	n/a
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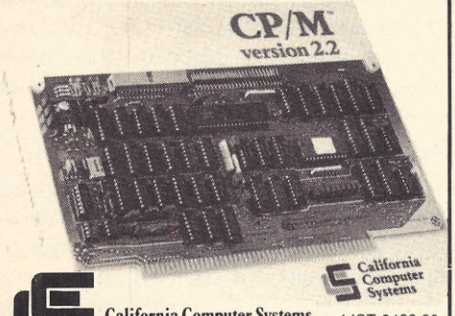
Latency (average)	83 ms	83 ms
Access Time		
Track to Track	8 ms	8 ms
Average	260 ms	260 ms
Setting Time	8 ms	8 ms
Head Load Time	35 ms	35 ms



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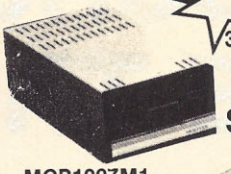

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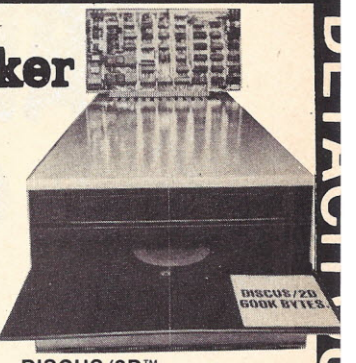

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PARTIAL SCROLLING ON THE TRS-80

by Jerry Kovacic

A common requirement in business programs such as general ledger, inventory, accounts payable or receivable is the ability to display a long list of items in some convenient fashion. We need some mechanism so that the user can view the information wanted. The scheme (or lack thereof) used by the TRS-80 for listing a program is definitely not suitable for a business environment. Often a heading must be displayed to explain, for example, the vendor codes, the transaction codes, etc., used in the listing. Even if this is not necessary, a heading is often desirable to remind the user of exactly what he is doing.

Two methods are commonly used. In the first, enough data is displayed to fill the screen; then the data display stops with a prompt 'hit enter to continue, X to abort' (say). The second method has data scrolling up the screen and asks the user to hit a key (any key) to stop or restart it. Unfortunately the heading is scrolled off the screen. You win some, you lose some.

With the first method, the program needs to keep a count of how many items are currently listed on the screen so that it can stop when the screen is full. Much data is conveniently arranged for this. A typical program segment is:

```
100 FOR J = 0 TO L STEP 14
110 CLS : PRINT "THIS IS THE HEADING"
120 FOR I = 1 TO 14
130 PRINT A$(I + J) : NEXT I
140 X$ = "" : INPUT "HIT ENTER TO CONTINUE, X TO ABORT";X$
150 IF X$ = "" NEXT ELSE STOP
```

To test this segment, add the lines shown in figure 1.

You probably already found the bug in this program. On the last page of display, we find 'bad subscript error'. This occurs because the program attempts to display A$(51) ,...,A$(56). A simple fix is as follows.

```
100 I = 1
110 CLS : PRINT "THIS IS THE HEADING"
120 FOR I = I TO I + 13
130 IF I > L STOP
140 PRINT A$(I)
150 NEXT
160 X$ = "" : INPUT"HIT ENTER TO CONTINUE, X TO ABORT";X$
170 IF X$ = "X" STOP ELSE 110
```

The code in line 120 is somewhat strange, but it works (it surprised me too).

The second method of displaying data is slightly harder than the first if we insist that the heading be reprinted. The crucial information needed is "where are we? ', that is, "what is the cursor position?" (We refer to the cursor position even if the cursor is not being displayed. The position is the position that the next character to be displayed would take.)

It is a pity that Basic does not provide us with access to the cursor location. The only function supplied is 'pos' which returns the position of the cursor within a line, that is, the position from the left-hand margin of the screen. What we need is position on the screen. No problem. Two 'peeks' and a little arithmetic can give us the answer. The formula is:

```
PEEK(16416) + 256*PEEK(16417) - 15360
```

This function returns 0 for the upper-left corner and 1063 for the lower right. In disk Basic we can define a function to compute this number. In level II, we can repeat the formula whenever it is needed or, if we use it frequently, we can perform 12 pokes, as detailed below, to do the job in machine language.

In level II, the function 'loc' produces 'L3 error', so is useless. We make it carry its weight by having it return the current cursor location: 0 for the top left corner and 1023 for the lower right. The assembly code needed is very simply:

```
2A 20 40 LD   HL,(4020H) ;cursor position, 3C00H = top left
3E 03    LD   A,3
A4       AND H           ;mask out 3C
67       LD   H,A        ;0 = top left
C3 9A 0A JP   0A9AH      ;load accumulator with answer
```

A question that always bothers an assembly language programmer is "Where do I put the **** thing?" In this case, the choice is easy. We do not want to hassle with memory size so we must use low memory. Where? Well, locations 16446 to 16511 are not used by level II. (They are, however, used by disk Basic for the clock, 'debug', etc.) We shall put the above code in these locations. We must also change the 'loc' jump vector to 16446 (403EH) from 12DH, which gives 'L3 error'. The following program performs the 12 pokes necessary.

```
10 FOR I = 16446 TO 16455
20 READ J : POKE I,J : NEXT          'Read in machine code
```

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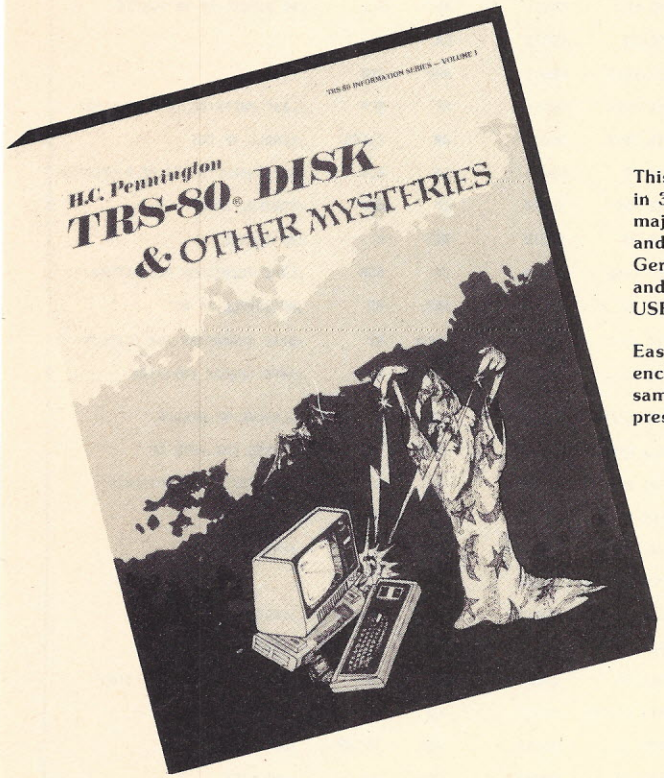

This valuable textbook, the first in a series by H. C. Pennington, has been reviewed in 3 major magazines and has been the topic of extensive conversation on two major computer communications networks. Presently, the book is being distributed and sold throughout the United States, Canada, the Union of South Africa, England, Germany, Australia, the Netherlands & others. William Barden, Jr., a well known and widely published computer author comments, ". . . my advice is to get it and USE it!"

Easy to read, entertaining material covers nearly every aspect of the many problems encountered on the TRS-80 system with disk storage. Actual examples, problem samples, memory maps, "how to fix . . ." solutions and countless illustrations are presented throughout.

Author: H. C. Pennington Publisher: IJG Computer Services
First Edition - Second Printing - Soft Cover - 130 Page
8½" x 11 — Wt. 1 lb. — Retail price: $22.50

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```
30 POKE 16741,62 : POKE 16742,64 'Change LOC jump vector
40 DATA 42,32,64,62,3,164,103,195,154,10
50 REM Data is the machine code converted to decimal
```

The function 'loc' requires one variable for proper syntax, so we use the dummy variable 0 (zero). Now if you type 'print loc (0)', you will find the current position of the cursor displayed. You can experiment with this by means of the following program.

```
10 INPUT "CURSOR POSITION" ; I
20 CLS : PRINT @ I, "*" CHR$(24); : J = LOC (0)
23 REM CHR$(24) backs up the cursor without erasing
26 REM or use the formula above in place of LOC(0)
30 PRINT @ 0, CHR$(30) "THE STAR IS AT" J
35 REM CHR$(30) clears the line
40 GOTO 10
```

A machine language (i.e., 'system') tape could be made, but it seems unnecessary to do so for only 12 pokes. It probably is more efficient to include this simple Basic routine into any program that requires this new function. Of course, if this is to be combined with other machine language routines, a 'system' tape would be indicated.

```
10 CLEAR 800 : L = 50
20 DIM A$(L)
30 FOR I = 0 TO L
40   A$(I) = "THIS IS LINE" + STR$(I)
50 NEXT I
```

Figure 1: Test data for programs in text.

The Basic program segment for displaying data that we presented earlier can now be rewritten:

```
100 PRINT @ 960,; :Intitialize at bottom of screen
110 FOR I = 1 TO L
120 IF LOC(0) 960 THEN 160 'Or use the formula
130 X$ = "" : INPUT"HIT ENTER TO CONTINUE, X TO ABORT";X$
140 IF X$ = "X" STOP
150 CLS : PRINT "THIS IS THE HEADING"
160 PRINT A$(I) : NEXT : STOP
```

Use the code of figure 1 to test this segment. In this simple example, it is not clear if there is any savings or not; however, the fact that the logic of the second version is easier than the first, gives it the edge when used in a complicated program. Also the second version will work properly (possibly with a change of the number 960) even if the data takes up a varying number of lines. The use of a counter, as in our first example, implies that the data uses the same number of lines.

At the beginning of this article, we mentioned two methods of displaying data. We generally prefer the second method, namely to give the operator a scrolling screen that he may stop as he desires. A nice variation of this asks the operator to hold down the space bar (or any other key that is convenient) to allow scrolling. To stop, merely release the key. This is easy to achieve. A simple 'inkey$' routine and perhaps a delay loop (most everyone I know is not as adept in speedreading as the people who invented 'list' seem to think) is all that is required.

```
7FB1            00001          ORG     7FB1H
7FB1 DA5804     00002 SCROLL   JP      C,458H     ;RETURN IF WRONG DRIVER
7FB4 216004     00003          LD      HL,460H    ;NORMAL RETURN ADDRESS
7FB7 E5         00004          PUSH    HL
7FB8 3A2440     00005          LD      A,(4024H)  ;FOOTER LENGTH
7FBB 2F         00006          CPL
7FBC C610       00007          ADD     A,10H      ;LAST LINE TO BE SCROLLED
7FBE CDF17F     00008          CALL    MUL        ;MULT BY 40H, PUT IN DE
7FC1 2A2040     00009          LD      HL,(4020H);CURSOR POSITION
7FC4 DF         00010          RST     18H        ;CP HL,DE
7FC5 D8         00011          RET     C          ;NO SCROLL IF IN FOOTER
7FC6 7D         00012          LD      A,L
7FC7 E63F       00013          AND     3FH
7FC9 FE3F       00014          CP      3FH        ;LAST POSITION IN LAST LINE?
7FCB 2807       00015          JR      Z,SCR      ;SCROLL IF YES
7FCD 79         00016          LD      A,C        ;GET CHARACTER TO BE DISPLAYED
7FCE FE0A       00017          CP      0AH        ;CONTROL CODE?
7FD0 D8         00018          RET     C          ;NO SCROLL
7FD1 FE0E       00019          CP      0EH        ;LINE FEED/CARRIAGE RETURN?
7FD3 D0         00020          RET     NC         ;NO SCROLL IF NOT
7FD4 C5         00021 SCR      PUSH    BC         ;SAVE CHARACTER FOR DISPLAY
7FD5 E5         00022          PUSH    HL         ;SAVE CURSOR POSITION
7FD6 3A2340     00023          LD      A,(4023H)  ;LENGTH OF HEADER
7FD9 CDF17F     00024          CALL    MUL        ;TIMES 40H INTO DE
7FDC ED52       00025          SBC     HL,DE      ;# BYTES TO BE SCROLLED
7FDE 44         00026          LD      B,H
7FDF 4D         00027          LD      C,L        ;INTO BC
7FE0 214000     00028          LD      HL,40H
7FE3 19         00029          ADD     HL,DE      ;SECOND LINE
7FE4 EDB0       00030          LDIR               ;SCROLL UP
7FE6 D1         00031          POP     DE         ;RESTORE CURSOR POSITION
7FE7 21C0FF     00032          LD      HL,0FFC0H  ;NEGATIVE 40H
7FEA 19         00033          ADD     HL,DE      ;MOVE CURSOR UP
7FEB 13         00034          INC     DE         ;ONE LINE
7FEC C1         00035          POP     BC         ;RESTORE CHARACTER FOR DISPLAY
7FED E5         00036          PUSH    HL         ;SAVE NEW CURSOR POSITION
7FEE C38005     00037          JP      580H       ;CLEAR LAST LINE, DISPLAY,RET
7FF1 EB         00038 MUL      EX      DE,HL      ;MULTIPLY BY 40H
7FF2 1E00       00039          LD      E,0        ;MULTIPLY BY 100H AND
7FF4 CB3F       00040          SRL     A          ;DIVIDE BY 4
7FF6 CB1B       00041          RR      E
7FF8 CB3F       00042          SRL     A
7FFA CB1B       00043          RR      E
7FFC C63C       00044          ADD     A,3CH      ;ADD IN START OF SCREEN
7FFE 57         00045          LD      D,A
7FFF C9         00046          RET
```

Figure 2: Assembly language partial scrolling routine.

There's always a "gotcha." The automatic scrolling routine does not respect the heading that was carefully placed on the screen. What we need is a "partial" scrolling routine.

A recent version of the level II Reference Manual presents a routine (page H-2) that performs a half-scroll: the top half remains stationary as the bottom half scrolls. The routine is particularly "cute" in that it stores the machine language program in a string

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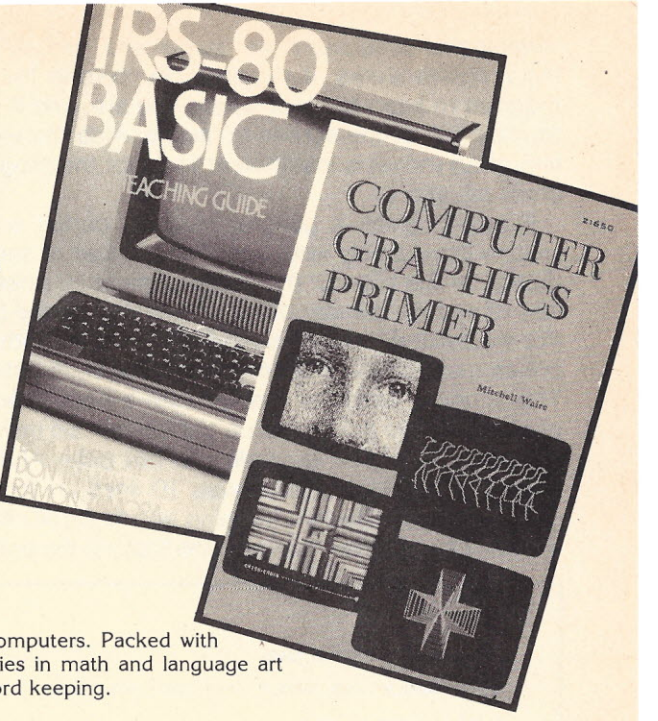

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variable and accesses it via 'varptr' and 'usr'. Although the program works, it requires counters in the Basic program to keep track of where you are, and it makes the last line of the screen unusable. Also the explanation given (none) is insufficient to adapt the program to other situations.

Figure 2 gives a general purpose partial scrolling routine in assembly language. The number of lines protected on the top (for the heading) must be poked into 16419 and the number of lines protected on the bottom (for the footer) must be poked into 16420. Both these pokes must be done before the program is activated. This program assumes that you are a careful user: no checking of the poked data is performed. So make sure it's consistent. For example, do not poke 16419,10 and poke 16420,6. This leaves 10 lines on top and 6 on the bottom. There is nothing left to scroll. At least two lines must be left between the top and the bottom. If

```
5 REM Set MEMORY SIZE at 32689
10 POKE 16419,0 : POKE 16420,0  'INIT SCROLL PARAMETERS
20 FOR I = 32689 TO 32767
30 READ J : POKE I,J : NEXT I
40 POKE 16414,177 : POKE 16415,127   'CHANGE VIDEO DRIVER ADDRESS
50 DATA 218,88,4,33,96,4,229,58,36,64,47,198,16,205,241,127
60 DATA 42,32,64,223,216,125,230,63,254,63,40,7,121
70 DATA 254,10,216,254,14,208,197,229,58,35,64,205,241,127
80 DATA 237,82,68,77,33,64,0,25,237,176,209,33,192,255
90 DATA 25,19,193,229,195,128,5,235,30,0,203,63,203,27
100 DATA 203,63,203,27,198,60,87,201
```

Figure 3: Level II 16K pokes for partial scrolling.

0s are poked into both 16419 and 16420, the scrolling is as usual. The listing is heavily annotated for those readers who are comfortable with assembly language.

Before we explain how to activate this routine, we must decide where to put it. It is 79 bytes long and therefore will not fit in the unused space (of level II) from 16446 to 16511. It is 14 bytes too long. The obvious solution is to use high memory, and set 'memory size' correctly.

The routine acts as a video preprocessor; it should be invoked whenever a byte is to be displayed on the screen. It checks whether scrolling is required or not. If not, it jumps to the usual video display routine and then back to your program. Thus, to activate it, we merely replace the usual video driver address with address of our program. A convenient way to poke the address of our program into 16414 and 16415. The Basic program given in figure 3 is suitable for a 16K machine.

If you have a 32K machine, set 'memory size' at 49073. Lines 20, 40, 50 and 70 must also be changed:

20 FOR I = -16463 TO -16385
40 POKE 16414,177 : POKE 16415,191
50 last datum should be 191
70 last datum should be 191

For 64K, 'memory size' is 65457, I = -79 TO -1 and the last data lines 40, 50 and 70 is 255.

Disk Basic users can use the program above, or they can put the routine into some unused space in Basic itself. Unused space in Basic? (One might think Radio Shack likes to sell memory expansion.) If you have disk Basic version 2.2, type in CMD"#"#. (Without the period.) The copyright message you see may be of importance to Radio Shack, but for personal use it is not needed. Following the copyright message, we find the following message: 'Protection has cleared memory'. We have never seen this message appear and cannot

```
403E            00001          ORG     403EH
403E DA5804     00002 SCROLL   JP      C,458H      ;SEE FIGURE 2 FOR COMMENTS
4041 216004     00003          LD      HL,460H
4044 E5         00004          PUSH    HL
4045 11C03F     00005          LD      DE,3FC0H    ;START OF LAST LINE
4048 2A2040     00006          LD      HL,(4020H)
404B DF         00007          RST     18H
404C D8         00008          RET     C
404D 3EFF       00009          LD      A,0FFH
404F BD         00010          CP      L
4050 2807       00011          JR      Z,SCR
4052 79         00012          LD      A,C
4053 FE0A       00013          CP      0AH
4055 D8         00014          RET     C
4056 FE0E       00015          CP      0EH
4058 D0         00016          RET     NC
4059 C5         00017 SCR      PUSH    BC
405A E5         00018          PUSH    HL
405B 3A2340     00019          LD      A,(4023H)
405E EB         00020          EX      DE,HL
405F 1E00       00021          LD      E,0
4061 CB3F       00022          SRL     A
4063 CB1B       00023          RR      E
4065 CB3F       00024          SRL     A
4067 CB1B       00025          RR      E
4069 C63C       00026          ADD     A,3CH
406B 57         00027          LD      D,A
406C ED52       00028          SBC     HL,DE
406E 44         00029          LD      B,H
406F 4D         00030          LD      C,L
4070 214000     00031          LD      HL,40H
4073 19         00032          ADD     HL,DE
4074 EDB0       00033          LDIR
4076 D1         00034          POP     DE
4077 21C0FF     00035          LD      HL,0FFC0H
407A 19         00036          ADD     HL,DE
407B C1         00037          POP     BC
407C C37C05     00038          JP      57CH        ;CLEAR TO END, DISPLAY,RET
```

Figure 4: Simplified partial scrolling routine.

determine the conditions under which it might. We shall overwrite this also.

The result is that locations 22572 to 22666 (582CH to 588AH) are now available for our use. If you have qualms about overwriting these messages, use locations 21699 to 21845 (54C3H to 5555H). These comprise a jump table that is used during initialization of

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Basic but never again. (The use of these memories implies that they are loaded after Basic is run, of course.)

The following program lines detail the changes that are required in the level II Basic program of figure 3 for the disk Basic version. It pokes the partial scrolling routine into the "copyright message" area.

```
 5 REM No need to set MEMORY SIZE
20 FOR I = 22572 TO 22650
40 POKE 16414,192 : POKE 16415,84
50 Change last two items to 108,88
70 Change last two items to 108,88
```

All other lines remain as in figure 3.

If we give up the ability to set the bottom margin, we can shorten the partial scrolling routine so that it fits into the unused area of level II Basic. There is little point to make this change for disk Basic as the room is available and the execution time is minimal (it is in machine language after all). The program is listed in assembly language in figure 4. The use is the same as before. The number of lines to be protected (at the top only) is poked into 16419. A Basic program that performs the required pokes is given in figure 5.

```
 5 REM No need to set MEMORY SIZE
10 POKE 16419,0
20 FOR I = 16446 TO 16510
30 READ J : POKE I,J : NEXT I
40 POKE 16414,62 : POKE 16415,64
50 DATA 218,88,4,33,96,4,229,17,192,63,42,32,64,223,216
60 DATA 62,255,189,40,7,121,254,10,216,254,14,208,197,229
70 DATA 58,35,64,235,30,0,203,63,203,27,203,63,203,27
80 DATA 198,60,87,237,82,68,77,33,64,0,25,237,176,209
90 DATA 33,192,255,25,193,195,124,5
```

Figure 5: Level II pokes for simplified scrolling routine.

Using a partial scroll routine (any of the ones described), we can give a neat solution to the problem of listing data. The following program segment scrolls the data on the screen. We use a delay loop so as not to tax the operator's reading speed. To stop the display at any time, hit any key. Restart it by hitting any key. We assume that there is a heading of one line that must remain on the screen at all times; this one line is protected by the poke in line 120. This segment may be tested by adding the code of figure 1.

```
100 REM Add the code of figure 1 for testing
110 CLS : PRINT "THIS IS THE HEADING"
120 POKE 16419,1 'Reserve 1 line for heading
130 FOR I = 1 TO L
140 PRINT A$(I)
150 IF INKEY$ <> "" 180
160 FOR J = 1 TO 25 : NEXT J 'Delay loop
170 NEXT I : END
180 IF INKEY$ <> "" 160 ELSE 180
```

A business-oriented program must pay attention to the details of proper video screen format if it is to be widely accepted. A partial scroll can often add a desired neatness by allowing a heading to remain on the screen while the data scrolls by. The general purpose scroll presented here may fill the bill. □

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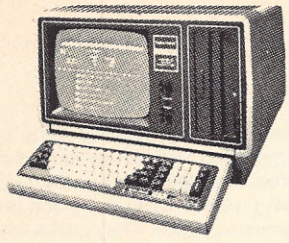

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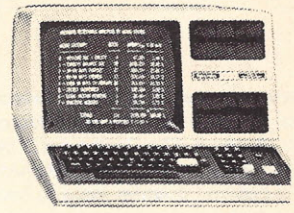

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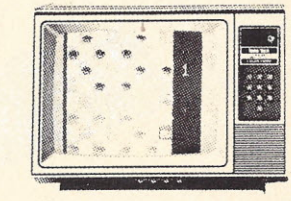

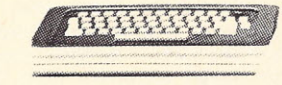

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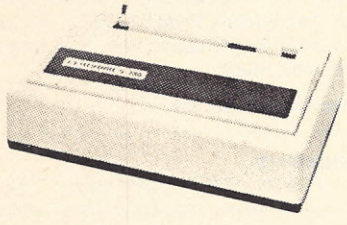

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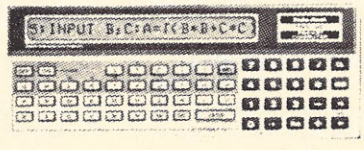

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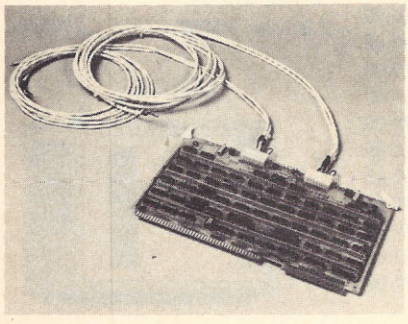
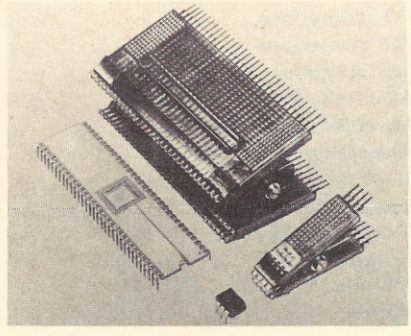
Two-axis stepping motor interface links a pair of open-loop stepping motor drives to the Multibus. The Controlsmith model PS-25 features on-board acceleration/deceleration and position counter logic to handle all real time motor tasks. Velocity programming permits precise path control of two or more axes in contouring applications. For optimum



motor performance, deceleration is the mirror image of acceleration. Programmed velocity offers a 255:1 dynamic range, and a maximum speed adjustable from 1000 to 10,000 steps/sec. Acceleration rates and maximum speed are independently adjustable for each axis. Price: $800. Controlsmith, Inc., 17 Airport Rd., Nashua, NH 03063, (603) 889-5986.

CIRCLE INQUIRY NO. 220

Dip test clips, Clip-a-dip SL, covers the range of 6/8 pin, 14/16 pin, 18/20 pin, 22/24 pin on .3-in. and .4-in. center, 24 pin of .5-in. center, 24/28 pin of .6-in. center, 36/40 pin of .6-in. center and 64 pin on .9-in. center. Features include: precision stamped, flat, gold plated phosphor bronze contacts,

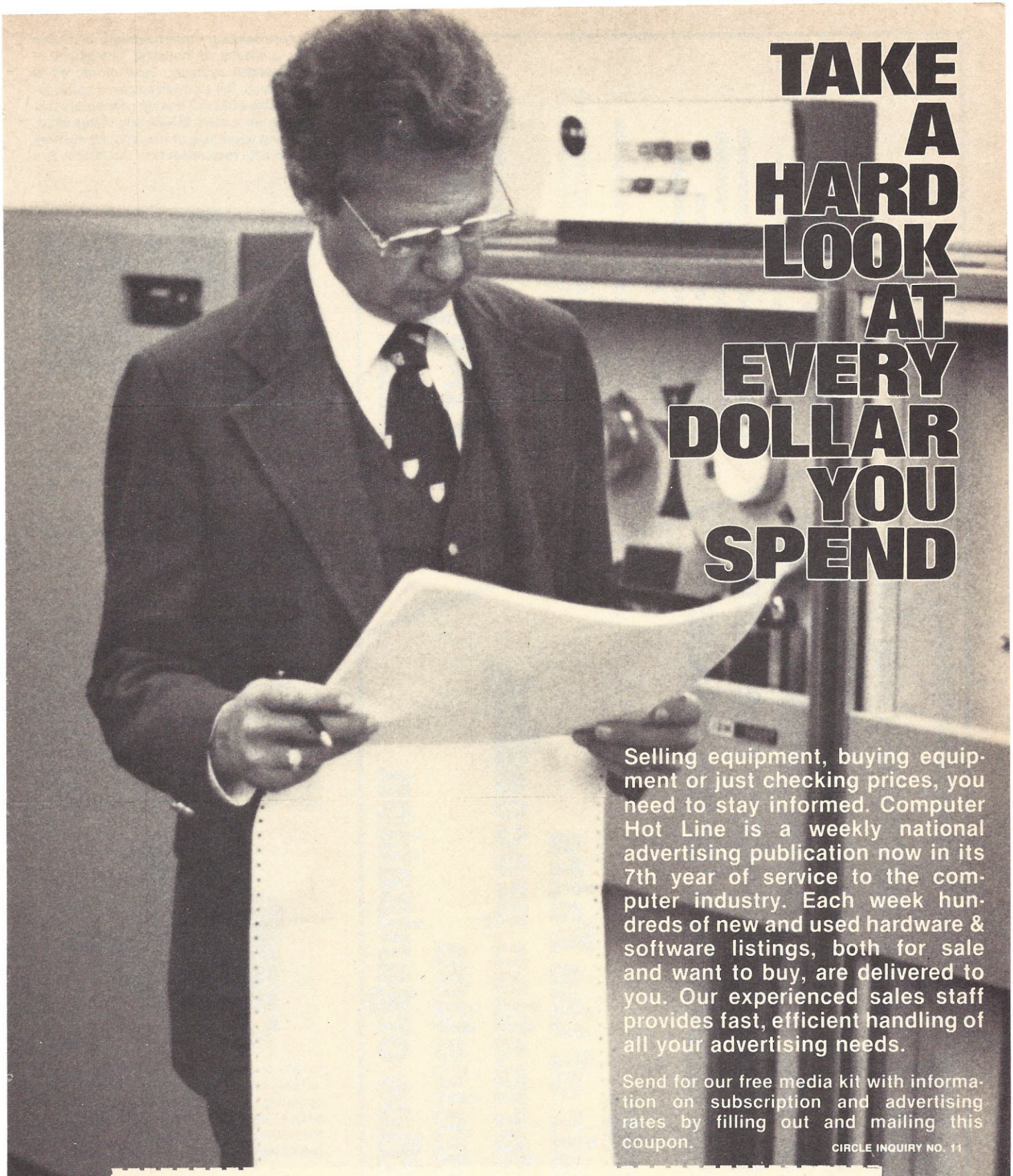


test points on upper end that accept wire wraps, test probes and interfacing connectors. Contact design provides both non slip probe attachment on top as well as access to base of contacts for additional probing. Micro Electronic Systems Inc., 159 Main St., Danbury, CT 06810, (203) 797-1441.

CIRCLE INQUIRY NO. 221

Daisywheel teleprinter terminal with a programmable keyboard, nonvolatile memory, bidirectional printing, optional 1200 bps full duplex operation and text enhancements, is well suited to interactive timesharing, word processing, remote data entry and point-to-point communications. The AJ 833 keyboard printer terminal features such optional text enhancements as proportional spacing, bold face printing, automatic centering, justification and underscoring. Its nonvolatile memory stores margins, tab settings, forms control and program key settings, pitch and plot modes. Every key can be programmed to perform any character function. Seven keys can be programmed to perform repetitive functions of up to 31 steps at the touch of a single key for automatic log-on operations or other routines. Standard print speed is 45 cps combined with a "look ahead" feature for optimized bidirectional printing with combined horizontal and vertical motion and space compression. A full 128-character Ascii character set is standard. The unit operates at selectable rates of 110, 150, 300 or 450 bps, and optionally at 600 or 1200 bps. A 2K-byte internal buffer is expandable by 32K-bytes. The high speed option provides a 3-way buffer overflow protection to prevent loss of incoming data and to assure optimum data throughput. Price: $3,995. Anderson Jacobson, 521 Charcot Ave., San Jose, CA, (408) 263-8520.

CIRCLE INQUIRY NO. 222



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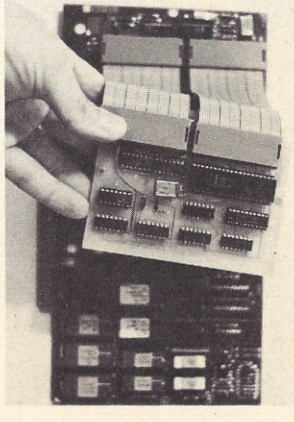
Microprocessor enhancement modules offer a means of boosting throughput in 8080A-based systems. Ease of retrofit is emphasized: the modules employ a software-compatible 8085A-2 and dip connectors that replace the system 8080A and status latch. By taking advantage of the reduced memory access time requirements of the 8085A-2, a

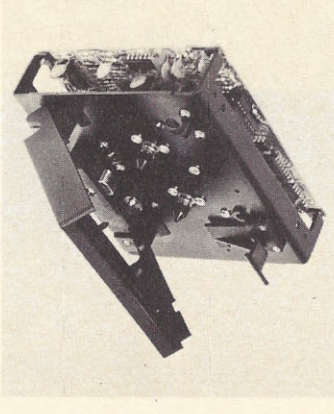


50 to 250% throughput increase can be realized over processor-limited applications. The result is immediately apparent in faster program execution, heightened interactivity and a general enhancement of system performance. Models are offered for most 8080A products at $350. Paragon Systems Inc., P.O. Box 2050, Corvallis, OR 97330, (503) 758-1029.

CIRCLE INQUIRY NO. 223

Digital tape transport features include an 8,000,000-bit storage capacity and a special auto-reversal unit. The double-track model 453 writes side A on the tape cassette; automatically switches between sides without operator intervention, and continues writing side B. One feature is the ability to perform read-after-write checking throughout this process. The transport never needs mechanical adjustment or alignment, and meets all ANSI/ECMA standards. The model uses MFE's DC45FL 450-foot cassette tapes. If the tape cassette is improperly loaded or upside down (side B up), a tape-sensing switch prevents the transport from operating. Price: $339 each for 100-unit orders. MFE Corp., Keewaydin Dr., Salem, NH 03079, (603) 893-1921.

CIRCLE INQUIRY NO. 224



Data programming system in a completely revised version is used with the Datacorders I and II. The Quick system enables users who have little or no experience in computer programming to generate customized data-entry programs. The user-friendly system is based on a question-and-answer format. Users can quickly and easily specify the desired program features for their data-entry application—simply by answering a series of questions. A fully illustrated and indexed manual, provides a complete guide to the

design, development, and testing of the programs. Simplified worksheets and coding forms are also provided. International Entry Systems, 408 N.E. 72nd St., Seattle, WA 98115, (206) 525-6800.
CIRCLE INQUIRY NO. 225

8080/8085 cross assembler program transforms virtually any computer into a complete development system. It can also be used with Fastprobe guided probe software to generate diagnostic programs for production test and field service of 8080/8085-based systems. Programs with the package include macro assembler generating relocatable object code, a linking loader and a formatter/downloader to transmit assembled programs to an emulator, analyzer or designer for program execution and debug. A comprehensive users manual and Fortran source code on floppy disk or magnetic tape are provided. Minicomputers supported include DEC PDP-11 and LSI-11 with either RT-11 or RSX-11 operating system, Data General Nova 1200 or Eclipse with either RDOS or AOS, HP 1000 or 3000 and TI 99/10. Cost: $1,500. Millennium Systems, 19050 Pruneridge Ave., Cupertino, CA 95014, (408) 996-9109.
CIRCLE INQUIRY NO. 226

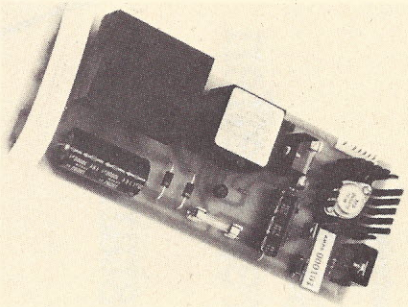
Foam molded CRT housings, series 700, are available off-the-shelf for immediate shipment. Components may be varied to customize the units. The internal base has a grit area that easily adjusts to many different components and layouts, making it useful to many OEM manufacturers. A natural interior overhang can also be bridged to form different configurations. Other features include style keyed components that give assemblies continuity and two size keyboards. The unit can be built to accept standard alphanumeric or added numeric pads. Up to 116 keys can be accommodated. Hettinga, Inc., 1800 S.W. Second Ave., Des Moines, Iowa 50315, (515) 243-2910.
CIRCLE INQUIRY NO. 227

Trigonometry programs for the Compucolor use a circular functions approach providing experiences with radian measure, the development of the sine function, graphing the sums of functions, drill with identities, and polar graphs. All programs are interactive requiring the user to guess with computer checking, to practice with computer checking, to enter choices of curves to be displayed, to recognize identities, and to notice patterns. The programs are fully documented with explanations of purpose and mathematics involved. Program listings are included so that users may create additional variations: e.g. to create an additional drill program using additional identities. Suggestions are provided to assist in these changes. The disk uses a 64 by 32 character screen with 127 by 127 color blocks in low and high resolution graphics. Price: $30. Metra Instruments, 2056 Bering Dr., San Jose, CA 95131.
CIRCLE INQUIRY NO. 228

8-in Winchester disk drives are compatible with Shugart SA1000. Using an innovative combination of proven design and manufacturing technologies, Quantum Corp. has developed a family of low cost 8-in fixed disk drives that are compatible with Shugart Associates SA1000 disk drives yet offer two

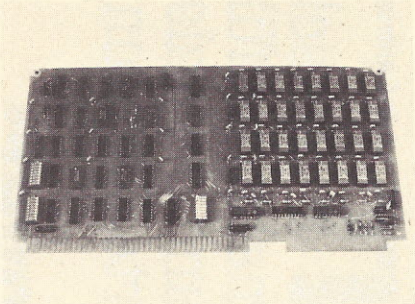
or three times the capacity. The Q2000 series includes drives with 10, 20 and 30 m-byte capacity. Features include: full SA1000 interface, mounting, and power supply capability; reliable Winchester head/media technology; proprietary moving coil rotary head actuator; unique temperature compensation servo track positioning system; improved access time; microprocessor control of drive functions. In OEM quantities of 500 per year, pricing is $1,200 for the 10 m-byte Q2010, $1,500 for the 20 m-byte Q2020, and $1,800 for the 30 m-byte Q2030. Quantum Corp., 2150 Bering Dr., San Jose, CA 95131, (402) 262-1100.
CIRCLE INQUIRY NO. 229

Power supply, designed to power a complete Aim-Mate system (AIM 65, Memory-Mate, Video-Mate and Floppy-Mate), the OEM type supply is slim enough (2¼ inches tall) to fit into many custom enclosures as well as the case. The 4-inch by 10-inch unit provides for 5V @ 3.5A, 12V @ 200ma, 24V @ .5A avg., accommodates either 115 or 230 VAC input and includes short circuit and



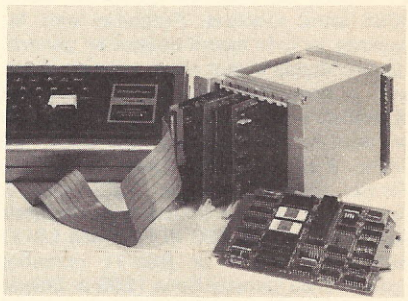
overvoltage protection. Price: $79. Forethought Products, 87070 Dukhobar Rd., Eugene, OR 97402, (503) 485-8575.
CIRCLE INQUIRY NO. 230

64K byte memory for Intel's Intellec MDS 800, SBC 80/10, SDK-86, and BLC 80/10 microcomputers is the CI-8080 memory module. It features easy expansion to 32K, 48K, or 64K bytes on a single board and is compatible with both 8 bit and 16 bit Multibus based systems. The CI-8080 is designed to plug directly into the memory slot of the MDS 800 and the SBC 80/10. It allows maximum processor throughput with the use of



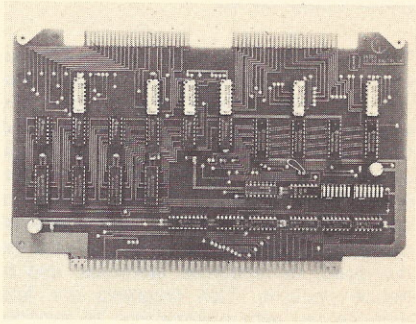
on board refresh control logic. Data access time is 270 nsec and cycle time is 400 nsec. The memory is addressable in 4K increments up to 64K words of memory. It is available with battery backup capability. The size is 6.75 inches by 12 inches, while power consumption is under 7 watts. Prices: $565 for 16K by 8 and $750 for 64K by 8. Chrislin Industries, 31352 Via Colinas #102, Westlake Village, CA 91361, (213) 991-2254.
CIRCLE INQUIRY NO. 231

STD bus I/O cards emulating the keyboard, cassette, and video functions of the TRS-80 can be used in conjunction with existing Z80 CPU and RAM cards to exactly emulate TRS-80 models I-III for software compatibility. Both OEM and individual applications are anticipated for those users desiring an industrial quality, expandable computer capable of executing model I-III compatible software without alteration. Although care was taken to insure functional compatibility, several important improvements were made to the



model I keyboard, cassette, and video designs. These include an improved cassette interface with a built-in AGC; lower case characters with distenders; 50 Hz strap option for non-US operation; external video sync provision; and multiple display capability. The user also has the capability of selecting the keyboard which best fits the particular application, since the keyboard interface card is compatible with any unit providing parallel Ascii data and strobe. QC Microsystems, P.O. Box 401326, Garland, TX, (214) 343-1282.
CIRCLE INQUIRY NO. 232

Parallel I/O module 96103 provides 32 terminated TTL compatible input and 32 TTL compatible latched and buffered output. This module emulates the function of the Motorola M68MM03 Micromodule. It can be placed at any 4-byte boundary of memory by setting the starting address in DIP switches



on the card. The I/O lines are available at two edgeboard connectors at the top of the card. Input termination and output pullup resistors are in separate packages allowing additional flexibility for system configuration. Price: $275. Creative Micro Systems, 11642-8 Knott St., Garden Grove, CA 92641, (714) 898-9669.
CIRCLE INQUIRY NO. 233

Income property analysis program, Incoprop, appeals to real estate brokers, sales people, counselors, educators, students and investors. The flexible program is based upon standardized methods of property analysis. The analysis generates a property operating statement and a 10 year cash flow analysis. Both of these detailed statements

are compatible with similar forms provided brokers by the National Association of Realtors. High accuracy of an investor's projected after-tax income stream is assured by the use of a built-in I.R.S. tax table. It is written for the TRS-80 model I or model III. Sold on cassette for easy transfer to disk, the program comes with a comprehensive 78-page user's manual and a pad of data worksheets in a 3-ring binder. Price: $120. E-Z Software, P.O. Box 591, Novato, CA 94947, (415) 388-0238.

CIRCLE INQUIRY NO. 234

Educational program, Introduction to Basic Programming, Part I, is part of a complete classroom package designed to provide students with a first experience in computer programming and requires little programming or computer knowledge on the part of the instructor. It includes a teacher's manual, a set of transparencies for use with an overhead projector and 25 student workbooks (additional workbooks are available separately). The package is designed to assist students in identifying important concepts, principles and techniques related to computer pro-

gramming and to provide them with a means of checking their knowledge of this information. It also gives students practice in applying their knowledge and skills in developing computer programs written in Basic. One or more 4K or 16K level I or level II TRS-80 model I systems are required. Price: $159.95. Radio Shack, 1800 One Tandy Center, Fort Worth, TX, 76102, (817) 390-3272.

CIRCLE INQUIRY NO. 235

Triple-output power supplies provide a total output of approximately 9.5 watts. Designed for use where space is limited, they combine all the features of dual output and 5 volt logic power supplies in a single compact package. The supplies provide DC voltage outputs of 5V @ 1000mA with ±12V @ 150mA, and 5V @ 1000mA with ±15V @ 150mA. Each is available in a printed-circuit card or chassis mountable

package. The units feature excellent line/load regulation with low ripple and noise, plus overvoltage protection on the 5 volt output. The power supplies are housed in cases

CIRCLE INQUIRY NO. 103

measuring 3.5 inches by 2.5 inches by 1.62 inches (PC mountable) and 4 inches by 2.7 inches by 2 inches (chassis mountable). Prices: $129 for PC mountable and $144 for chassis mountable. Power Products, 1400 N.W. 70 St., Ft. Lauderdale, FL 33309, (305) 974-5500.

CIRCLE INQUIRY NO. 236

Word processing program in 8K and 16/32K versions is now used extensively for expanding the capabilities of Commodore Pet microcomputers. The CmC program permits composing and printing letters, flyers, advertisements, manuscripts, and other documents using the Pet and a printer. One of the printers most widely applied is the versatile NEC Spinwriter interfaced to the Pet with a CmC ADA1600 or ADA1450 IEEE-488 adapter. The software incorporates print directives including line length, line spacing,

left margin, centering, and skip. Edit commands allow the operator to insert lines, delete lines, move lines and paragraphs, change strings, save files onto cassettes, load files from cassette, move up, move down, print, and type. The system can be modified for disk storage. Added features for the 16/32K version include string search for editing, keyboard entry during printing for letter salutations, justification, and multiple printing. The 8K version lists for $29.50; the 16/32K version, $39.50. WPP, Connecticut Microcomputer, 34 Del Mar Dr., Brookfield, CT 06804.

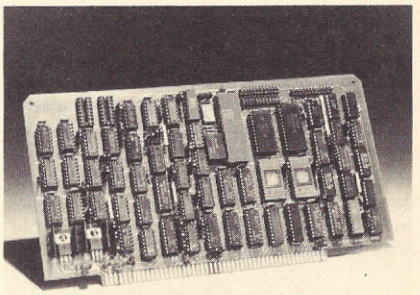
CIRCLE INQUIRY NO. 237

Desktop small business system, SD-605/610, combines the 8-inch Winchester hard disk with processing technology of SD Systems microcomputers. The system offers

the Shugart 8-inch Winchester hard disk with up to 10 Mb of storage and 1 Mb of floppy disk backup. Bob Sherman, SD Systems, 3401 W. Kingsley, Garland, TX 75041.

CIRCLE INQUIRY NO. 238

16-bit CPU board, C-86, compatible with the IEEE-696 S-100 bus standard, uses Intel Corp.'s 8086 16-bit microprocessor and features an on-board local bus that contains 2K by 16 bits of Prom, an RS-232-C serial I/O port, a software programmable timer, and a special expansion connector. This connector allows for other Intel co-processors such as the arithmetic and I/O processors.



Operating system software and high level languages are available for the 8086 and can be interfaced into a powerful micro with performance comparable to that of a mini. The standard 5 MHz costs $725, the 8 MHz $825. Piiceon, Inc., 2350 Bering Dr., San Jose, CA 95131.

CIRCLE INQUIRY NO. 239

Color graphics board, HA-8-3, is designed for use with Heath's H-8 and all-in-one computers. It uses the advanced TI-9918 color video display generator, from Texas Instruments. To produce nearly any sound desired for games and other applications, an AY-3-8910 programmable sound generator is also included. Eight channels of analog-to-digital conversion can handle up to 4 X-Y joystick consoles (not included). Each console

has 4 bits of parallel input/output (I/O) for switches or LEDs. A socket is also provided for the AMD-9511 arithmetic processor chip (not included) to permit extremely rapid floating point, trigonometric and transcendental computations. The chip can also perform hardware multiplication/division of both integer and floating point numbers. The board connects to the video input of most video monitors as well as other video accessories utilizing NTSC composite color video. Heath provides demonstration software on a 5.25-inch floppy disk, at no additional cost. Price: $395. Heath Co., Dept. 350-390, Benton Harbor, MI 49022.

CIRCLE INQUIRY NO. 240

Professional software packages for the dentist, attorney and consultant are designed to utilize the popular desk type computer for appointment scheduling, professional time management, private client billing, and management reporting. The dental system features preparation of A.D.A. claims forms for third party patients. The system also allows the professional to locate and prepare notices for professional dental checkups automatically on the schedule the dentist feels advisable for his patients. The second package is geared to the needs of the legal profession. The system features preparation of special reports for third party legal plans and special accounting plans to analyze court time usage, and work on retainer or contingency engagements. The third variation is a general purpose package for consultants, accountants and contract administrators. This system allows the creation of sub-jobs, special cost centers, overhead accounts, billing under time and materials contracts, fixed priced job cost accounting and many other job set up systems. All systems include daily cash reports, time utilization, and professional service reporting. Monthly reports include full aged accounts receivables by client and class of client as well as third party payors. Management control is fostered by a complete statistical reporting and analysis package which is so flexible it can be used to manage personal finances or client trust funds. All systems require an Apple II or Apple II Plus computer with Applesoft, a 130 column printer, and at least two mini floppy disk drives. The system will handle up to 150 professional practitioners with client bases of up to 10,000 clients each. Price: $750 for the selected package. CompuSoCo, 26251 Via Roble, P.O. Box 2325, Mission Viejo, CA 92690.

CIRCLE INQUIRY NO. 241

Communication software package, RT-2848, consists of a set of program libraries, allowing the exchange of data between two or more (up to 31) 8080/8085 microprocessors on an asynchronous serial line. The communication protocol (similar to IBM 2848) establishes connections, handles error control (including retransmission) and gives software warnings for debugging. There are two versions: one runs under the RMX/80 operating system, the other does not need an operating system. Elema S.p.A.-Via Legnano, n° 26-20121, Milan, Italy, Telex: 31-40-33.

CIRCLE INQUIRY NO. 242

Project management software package, Milestone, is a low-cost package designed to operate on most systems using CP/M or UCSD Pascal operating systems. The package is based on critical path network analysis techniques that have previously been available only on large minicomputer systems. These same techniques are now available for smaller projects commonly encountered in business, government, engineering and construction projects. Unlike earlier PERT/CPM programs for large mainframe computers, Milestone is interactive—it immediately displays the results of a scheduling change on the terminal screen. It is useful for any project that can be broken into a series of distinct tasks, each with a duration, a level of manpower and a cost. It automatically lays out each job against a time scale showing which tasks are critical and which can be delayed. It also displays the manpower and expenses versus time, as well as the totals and project completion date. The original plan can even be altered during the course of a project to reveal the impact of any scheduling changes. It is available for microcomputers such as Apple, TRS-80, and many S-100 systems. It requires an 80 by 24 screen and 48K of RAM. Price: $395. Dr. Michael Posehn, Organic Software, 1492 Windsor Way, Livermore, CA 94550, (415) 455-4034.

CIRCLE INQUIRY NO. 243

Linear systems analysis software for series 9800 system 35 and system 45 desktop computers brings together the classical tools for analyzing linear systems. The software includes modules for entering the system design into the computer, producing analysis plots of the system performance, and editing the design to tweak the system. The software will be useful to electrical, mechanical, and chemical control engineers,

as well as electronic circuit designers, communications engineers, and applied mathematicians. The software capability to analyze single-input/single-output linear systems which have an overall transfer function to the order 19 or less or which have block diagrams with 20 or fewer blocks and nodes. It will run on either the HP 9800 system 35A or the system 45B/C desktop computers. The HP system 35A must be configured with 128 K-bytes of read/write memory and a plotter graphics ROM; additionally, an HP 9872A/B 4-color plotter (with HP-IB interface) is required. An HP 9800 system 45B/C must be configured with 187 K-bytes of read/write memory, graphics subsystem, graphics ROM, and internal printer. The 4-color plotter can be optionally added to the system 45 configuration. Price: $500. Hewlett-Packard, 1501 Page Mill Rd., Palo Alto, CA 94304.

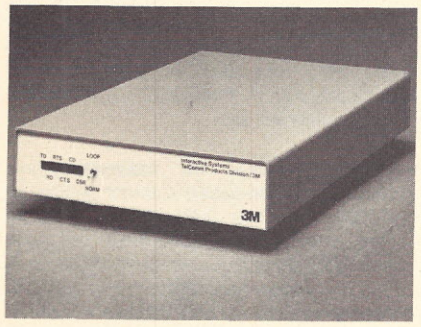
CIRCLE INQUIRY NO. 244

Analog input module, Aim16, forms a series of interface sets for the Pet, Apple, Kim, and TRS-80. The module is used industrially for data acquisition, testing, laboratory applications, alarm systems, and in-plant energy conservation by making real world variables accessible to the microcomputer.

The unit connects to the host computer through 8-bit input and output ports, or through custom interfaces. There are no special wiring requirements, and each of the 16 inputs is converted to an 8-bit digital signal. Price: $179. Connecticut Micro-Computer, Inc., 34 Del Mar Dr., Brookfield, CT 06804, (203) 775-4595.

CIRCLE INQUIRY NO. 245

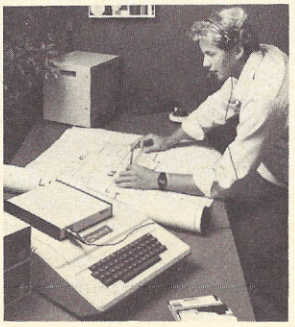
RF data modem for point-to-point broadband coaxial cable networks, the model 920, is designed for half or full duplex operation and can be used with other data modems, audio modems and video devices on a fully-loaded coaxial cable network. When interfaced with intelligent terminals, the modem can be used



for multi-drop as well as point-to-point system applications. Data rates are 600 to 9600 bits/second synchronous, and up to 10K bits/second asynchronous. RTS/CTS delay times of .30, 8 or 55 msecs may be selected. 3M, P.O. Box 33600, St. Paul, MN 55133, (612) 733-1186.

CIRCLE INQUIRY NO. 246

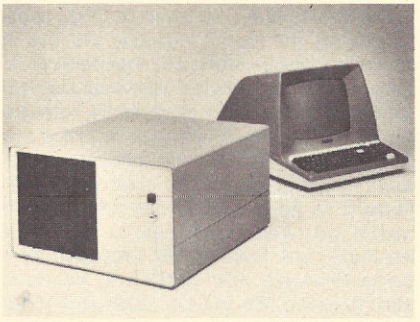
Voice entry terminals, VET/2, permit voice units to interface directly with any 48K Apple II computer. The terminal plugs into any slot in the Apple II and is linked functionally to the keyboard, which allows the user to choose keyboard input or voice input at any



time. It is supplied with preprocessor, interface board, software with demonstration programs, noise-cancelling headset microphone, and operator's manual. Price: $895. Scott Instruments, 815 N. Elm, Denton, TX 76201.

CIRCLE INQUIRY NO. 247

16 megabyte storage is possible with QT System +. The system includes mainframe, two 8-inch disk drives, double-sided double-density 5¼-inch and 8-inch floppy disk controller, power supply, fan and Televideo 920C terminal. This 4MHz/Z80/CPU system includes such features as: 48K dynamic memory (expandable to 64K); 2K monitor program and disk Bios on 2716 Eprom; RAM/ROM/Prom in any combination up to 8K; two RS-232C serial I/O ports; two parallel I/O ports; hard disk compatible; real time clock; CP/M 2.2 operating system;

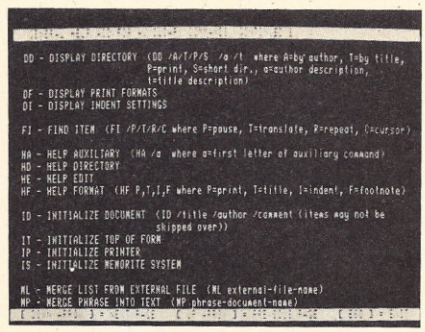


power-on reset jump to monitor program. The system is designed for both businessmen and engineers. Among other functions, it can be used for accounting and word processing, as well as a variety of scientific applications. The one megabyte single-sided, double-density system sells for $4,295, while the two megabyte double-sided, double-density unit is priced at $4,995. The units are assembled, tested and burned in at the factory. Each system includes documentation and has a one year warranty against defects in material and workmanship. QT Computer Systems, 15620 S. Inglewood Ave., Lawndale, CA 90260, (213) 970-0952.

CIRCLE INQUIRY NO. 248

Word processing package, Memorite III, runs on any of the Vector Graphics four integrated information systems. It offers more than a dozen added features including a built-in quick reference manual that displays

answers on command; fast editing due to a memory that can hold up to 17 pages without accessing a disk; and software that's accessible by programmers so that user-oriented features can be easily added in the field. The system offers automatic spelling verification from a 30,000-word dictionary;



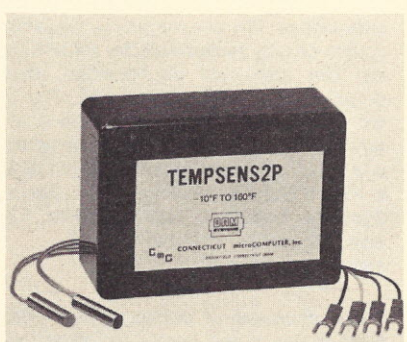
user-defined phrase library for rapid, automatic pick up of stock terms, phrases or paragraphs; and advanced mailing list capability including merging for direct mail addressing and printing. A security system using individual passwords to keep out unauthorized persons is a standard feature along with automatic alphabetizing of the document directory for display; as a user-reminder, a short description of each document appears with the alphabetized list. Price: $450. Vector Graphic, 31364 Via Colinas, Westlake Village, CA 91362, (213) 991-2302.

CIRCLE INQUIRY NO. 249

Circuit card, Ramcard, for the Apple II provides an additional 16K RAM memory to Apple users, converting a 48K to a 64K system. It is completely compatible with the Softcard peripheral and can be used with all software available. This provides a full 56K CP/M environment. The added memory substantially expands the utility of Microsoft's CP/M languages for the Apple—Fortran-80, Cobol-80 and Basic-80—and of CP/M applications for the Apple, including the line of business software offered by Peachtree Software. It can also provide additional memory space for Visicalc and other Apple software packages. It is easily installed in just a few minutes using step-by-step instructions provided in the package. The card requires an Apple II or Apple II Plus with 48K RAM; it cannot be used in addition to the Apple language card. Price: $195. Microsoft Consumer Products, 400 108th Ave. NE, Suite 200, Bellevue, WA 98004, (206) 454-1315.

CIRCLE INQUIRY NO. 250

Microcomputer-compatible temperature probes are provided with the module Tempsens. It enables direct temperature input for a variety of popular microcomputers including Pet, Apple, Kim, and TRS-80. Operating within a temperature range of −10°F to +160°F, each module provides two temperature probes to the CmC Aim16 analog input module using a CmC Manmod1 for ease of interconnection. Temperature probes are hermetically sealed and of high-quality, corrosion-resistant construction, with 12-foot leads. The Manmod1 will accept input from up to eight modules for a total of sixteen individual temperature probes. The Aim16, a sixteen input analog-to-digital converter, converts each proportional voltage input into bits for computer processing. Price: $49.95. Tempsens, Connecticut Microcomputer, 34 Del Mar Dr., Brookfield, CT 06804, (203) 775-4595.



CIRCLE INQUIRY NO. 251

132-column printer can produce correspondence-quality overlapping dot-matrix characters at high print speed. Model 560 is intended for data and text processing applications, prints bidirectionally at speeds up to 150 characters per second and is about half the size and weight of most 132-column machines. In addition to proportional character spacing, automatic text justification, variable character sizes and advanced forms control functions, the model offers a raster graphics printing option. The unit has a standard RS-232C serial interface as well as

a Centronics-compatible parallel interface. Serial transmission rates from 110- to 9,600 baud are switch-selectable. Price: $1,695. Integral Data Systems, Milford, NH 03055, (603) 673-9100.

CIRCLE INQUIRY NO. 252

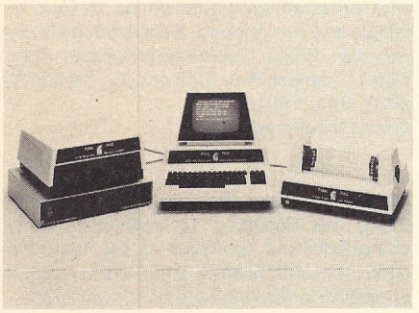
Diagnostic package for CP/M, Diagnostics-II, will thoroughly test memory, terminal, CPU, printer and disk. Every test is submittable, and the output from the tests may be directed to either the console or a disk file. This provides for unattended operation. Features include: default to the size of the CP/M TPA, printout of a graphic memory map, burn in test, memory speed check and bank select option. It includes the CPU test for 8080/8085/Z80. Price: $100. Supersoft Assoc., P.O. Box 1628, 40 Main St., Suite 402, Champaign, IL 61820, (217) 359-2122.

CIRCLE INQUIRY NO. 253

Inventory control for manufacturers package for CP/M-based systems written in PL/I takes up less RAM than a program written in Basic that accomplishes the same task. A program can contain far more features than other programs and this extra capacity is used to maintain a high degree of control in detecting error conditions. All invalid entries are detected as soon as they are made, and the operator receives an easily-understood explanation of what went wrong. Indecipherable error codes requiring refer-

ence to a manual are practically eliminated. Microcomputer Consultants, P.O. Box T, Davis, CA 95616, (916) 756-8104.
CIRCLE INQUIRY NO. 254

Programmable data logging system, the Fidac 7240, featuring Basic- and assembly-language programming, CRT display, full typewriter keyboard and program/data storage capability, is designed for production testing, small-scale process monitoring and control, and data pre-processing appli-



cations for large-scale computers. The system offers a range of plug-in function cards for analog and digital signals, plus mini-disk memory and impact printer options for versatility. Prices start at $4,500. F.I. Electronics, 968 Piner Rd., Santa Rosa, CA 95401, (707) 527-0410.
CIRCLE INQUIRY NO. 255

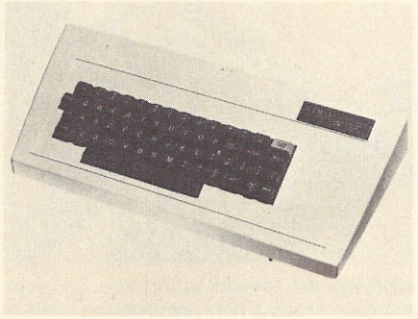
Intelligent computer printer, the Typrinter 221, is a letter-quality daisy-wheel with five built-in microprocessors, providing complete text formatting including right justification, proportional spacing, and a variety of other features. Also functions as a sophisticated electronic typewriter. The printer utilizes a parallel Centronics interface, with RS-232C and IEEE-488 interfaces also available. It can respond to formatting commands imbedded in the text, eliminating the need for

additional text formatting software, can automatically provide right justification, with or without proportional spacing; tabbing; bold and/or underlined characters; title centering; and decimal point location. The user can select from three different sizes of type (elite, pica, or mikron) as well as proportional spacing. Each standard daisy wheel has all the characters necessary to print in Spanish, Italian, French and German as well as English; correctable carbon ribbons in five colors as well as reusable nylon are available. Price: $2,750. Howard Industries, 2031 E. Cerritos Ave., Bldg. 7K, Anaheim, CA 92806.
CIRCLE INQUIRY NO. 256

Tax planning program, Shortax, enables professionals to forecast and analyze federal and social security taxes—a task which would normally take hours—in just minutes. It will calculate: federal income tax (using tax rate tables, income averaging formula, optional maximum tax method and the corporate alternative tax calculation for long term capital gains); the add-on minimum tax; the alternative minimum tax; the FICA tax; and the self-employment tax. Total input to output time, which is the only meaningful time measure, is less than four minutes. Data input, which is cross-referenced to tax forms with on line instructions, consists of just 20 variables. Detailed instructions are available in response to "?" or "help" input. Interactive and menu-driven, the program will run on most micro systems that use a Micropolis disk operating system and a CPU with at least 48K of memory. It will also run on a Radio Shack model I, level II with 48K of CPU memory and one (or more) Radio Shack disk drives. A version is also available on the United Computing Systems timesharing network using, a subaccount assigned to customers of Syntax Corp. Price: $500. Syntax Corp., 4500 W. 72nd Terrace, Prairie Village, KS 66208, (913) 362-9667.
CIRCLE INQUIRY NO. 257

Keyboard terminal modules, the KTM-3s, provide full Ascii keyboard, composite video for user-supplied CRT monitor and power supply in a handsome white case. The units come in two versions—a 40 character display width and an 80 character display width (KTM-3 and KTM-3/80 respectively). They represent the low-cost approach of splitting up the terminal into the keyboard/digital electronics and using a standard CRT monitor. The units consist of a 58-key keyboard which generates the full 128 Ascii set of upper and lower case alphanumeric char-

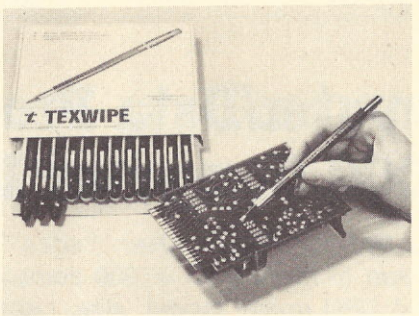
acters using an 8 by 10 field size matrix. Video control is provided for scrolling, full cursor control, and absolute, as well as relative, cursor positioning. Clearing can be achieved to end-of-line or end-of-screen. The KTM-3s provide even, odd, or no parity with one or two stop bits. Framing and parity errors are displayed. With its switch-



selectable baud rates of 110 to 19.2K and its control and character generator ROMs compatible with Eproms, the units are easily customized. Price for the KTM-3 is $389 and the KTM-3/80 is $449. Synertek Systems, 150 S. Wolfe Rd., Sunnyvale, CA 94086, (408) 988-5600.

CIRCLE INQUIRY NO. 258

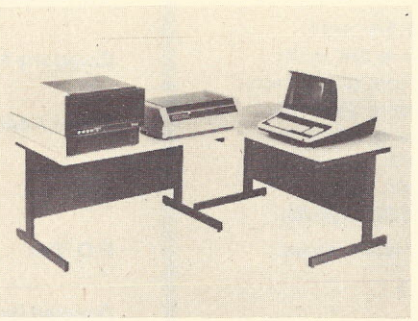
Solvent cleaning pen to remove soils, ink, and other contaminants from tiny crevices and small critical areas, has a barrel containing cleaning agent. When pressure is applied to the tip, a valve releases a measured amount of solvent onto the surface being cleaned. Cleaning nibs are non-abrasive and



will not lint or fuzz. A replacement nib is housed at the top of the pen. Holds a range of solvents: freon TF, freon TP-35, isopropyl alcohol, or flux remover blend. Priced at $32/dozen. Texwipe Co., Upper Saddle River, NJ 07458.

CIRCLE INQUIRY NO. 259

Desk top system, the RX15 Sprinter, is a low cost model with word processing capa-



bilities. It is a multi-tasking, multi-terminal hard disc based system offering substantially greater storage capacity, convenience, versatility and upward expansion capability, both from the standpoint of hardware and software. It also offers simultaneous data processing capabilities. The RX15 Sprinter is priced to the Rexon dealers in quantities of over 50 per year at approximately $10,000. The unit is based on the advanced Intel 8086 16-bit microprocessor with 64K RAM, incorporating a 10 megabyte, cartridge hard disc drive with 5 megabytes of storage fixed and five removable. It utilizes Rexon's Recap software for quick response operation with different programs on up to four terminals and two printers, all operating simultaneously. Rexon Business Machines Corp., 5800 Uplander Way, Culver City, CA 90230, (213) 641-7110.

CIRCLE INQUIRY NO. 260

Direct connect modems, Microconnections, are designed to interface popular computers and terminals to the telephone network. Units feature Bell 103 compatible operation in the originate or answer mode. A direct connection to the telephone line eliminates the problems associated with acoustic coupled modems and provides high sensitivity, low error rates and noise free

performance. Device permits automatic connection to other computers via the telephone network, with unattended data transfer such as message sending and retrieval. A detector is provided for ring counting and preset answer conditions. Prices start at $199.95. Microperipheral Corp., 2643 151st Pl. N.E., Redmond, WA 98052.

CIRCLE INQUIRY NO. 261

GSA-certified Cobol compiler, CIS Cobol, runs on Apple II computers with CP/M operating systems and in conjunction with the Z80 Softcard, which makes available the Z80 instruction set, in addition to Apple's 6502 microprocessor. It supports an optional screen formatter/program generator—Micro Focus' Forms-2—which greatly reduces the time needed to develop screen-processing applications widely used in business. The compiler is widely used on 8080- and Z80-based microcomputers running CP/M; users can now transfer programs between Apple II and other CP/M machines. It is also available on DEC's LSI-11 and Texas Instruments' TI 990 equipment. Micro Focus, 1601 Civic Center Dr., Santa Clara, CA 95050, (408) 496-0176.

CIRCLE INQUIRY NO. 262

CP/M operating system for Heath H-8 and H-89 computers will allow access to a vast library of CP/M-based software. Programs written under Heath Standard CP/M can run on any other system using CP/M. Three

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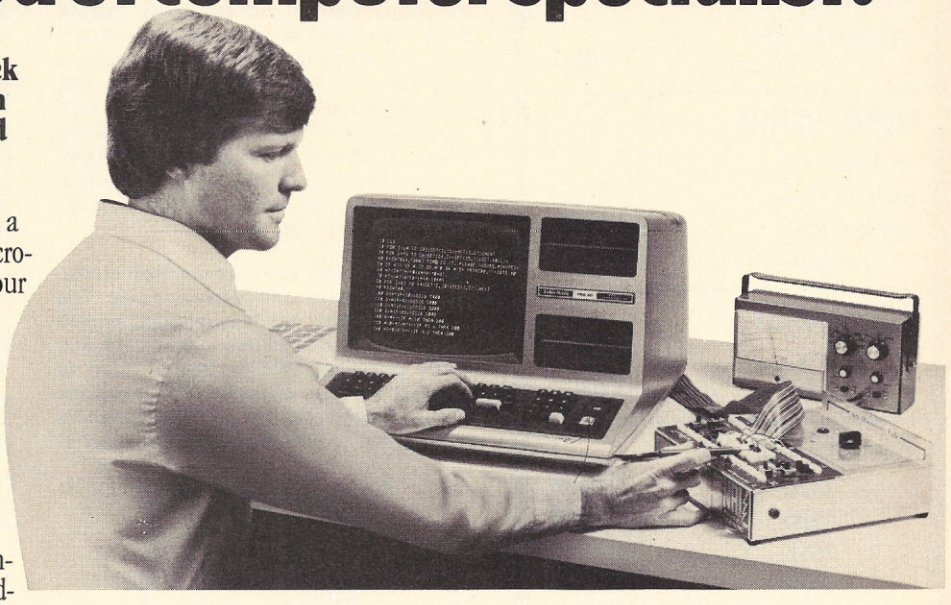

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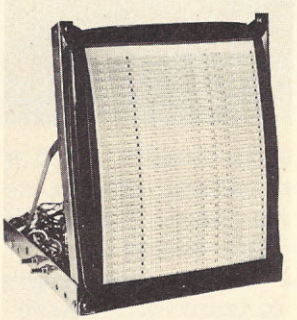
operating system modules (BIOS, BDOS, CCP) are included. BIOS, which has been implemented as a disk resident relocatable file on the Heath version of CP/M, contains all hardware-level I/O code. BDOS has all file level and logical I/O code, while CCP is the transient monitor—providing command-level communications between the user and CP/M. Utilities included are a two-pass absolute 8080 assembler; a text editor; an 8080 debugger with traced execution and disassembly; file dump; system generation and relocation; programs to display file sizes and disk usages, set file class, assign physical and logical devices, display system parameters, copy files between devices, and convert internal HEX files into memory images. It supports all 5.25 and 8-inch Heath disk systems, all Heath-offered printers and hard copy terminals. Full source code for hardware drivers—including disk drivers—is provided. Price: $150. Heath Co., Dept. 350-620, Benton Harbor, MI 49022, (616) 982-3210.
CIRCLE INQUIRY NO. 263

Raster scan WP monitor is a high resolution, high density CRT display module. The low cost module, VR-800, displays an 800 by 768 non-interlaced raster using a 15-inch P-104 phosphor CRT. It can be used to generate 66 lines of upper and lower case alphanumeric characters with 80 characters to the line. The entire screen is refreshed at



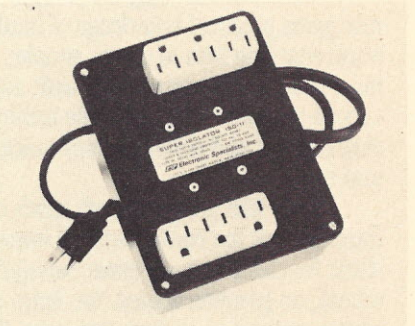
60 Hz, producing a totally flicker free image. The 50 kHz scan rate, coupled with a video bandwidth of 65 mHz produces clearly defined pixels 6 mils in size. The standard phosphor is P-104. Price per/100 is less than $600. Moniterm Corp., 250 N. Central Ave., Wayzata, MN 55391, (612) 475-1106.
CIRCLE INQUIRY NO. 264

Mainframe APL, AlphaAPL, for the Alpha Micro, has been enhanced with mainframe features. System variables, system functions, I-beam, component I/O and other features have been incorporated into Release 2.0. It is a multi-user APL and provides an alternative to mainframe timesharing. It runs under the Alpha operating system, and can be used with any Ascii or APL terminal. Assembler subroutines can be called directly from an APL program. The computer is a 16-bit CPU that runs on the S-100 bus. The floating point hardware provides the user with 11 digit accuracy. The package includes the APL language, a user's manual, source for many external subroutines, and assembler subroutine development aids. Price: $500. Softworks Limited, 607 W. Wellington, Chicago, IL 60657, (312) 327-7666.
CIRCLE INQUIRY NO. 265

Two business systems, AM-1051 and AM-1031, are connected via the Alphalink which allows up to eight Alpha Micro CPUs to be linked, enabling the systems to share both peripherals and data bases. Standard with both systems is 64KB system memory which is expandable to 1024KB. Also standard with the AM-1051 is 90MB of hard disk storage, while the AM-1031 comes with 10MB hard disk. Both systems can be expanded to include additional hard disk drives (up to four 10MB or 90MB drives or a combination of both); magnetic tape subsystems (up to four 9-track 800/1600 bpi); terminals and printers in a mix of up to 24; and communications controllers. Alpha Micro, 17881 Sky Park N., Irvine, CA 92713, (714) 957-1404.
CIRCLE INQUIRY NO. 266

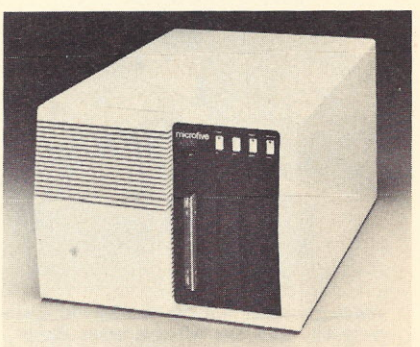
Data and word processing for business or scientific applications, MT500 system, features a full video display, Z80A microprocessor, CP/M operating system, 64K-bytes of RAM, two 500K-byte 5¼-inch floppy disk drives, and Selectric-type keyboard. A 45-cps letter-quality printer is available as an option, as well as a wide variety of business and scientific applications software. Other options include higher speed printers and integral 103- or 212A-compatible modems. Price: $6,000. Maatra Corp., 1835 W. Shryer Ave., Roseville, MN 55113.
CIRCLE INQUIRY NO. 267

Super isolator designed to curb severe AC power line spikes, surges and hash, and unexplained crashes, memory loss or other glitches, the model ISO-11, features two individually dual-Pi filtered AC socket banks



(6 sockets total). Heavy-duty spike/surge suppression is incorporated and equipment interactions are eliminated. Price: $98.95. Electronic Specialists, Inc., 171 S. Main St., Natick, MA 01760.
CIRCLE INQUIRY NO. 268

Business computer system combining 8-in Winchester, 8-in floppy disk, and ¼-in cartridge tape drives, the Microstar 3000,



provides 10 to 34 megabytes of hard disk storage, 1.2 megabytes on a double-sided floppy disk, and 13 megabytes for cartridge

Apple II or Apple II Plus w/16K RAM

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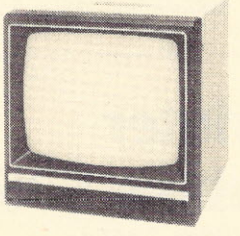

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Epson MX-80 (80 column Dot Matrix)	CALL
Anacom Anacom 150-132 Column Dot Matrix 150 CPS, Bidirectional, logic seeking upper & lower case with decenders. Serial or Parallel	1250.00

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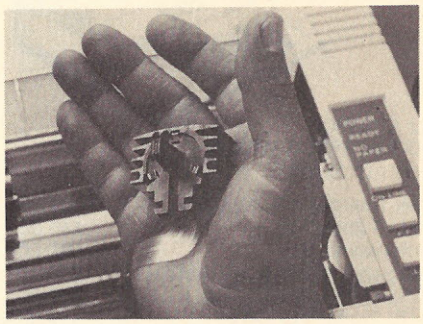
tape back-up. The 16-bit computer incorporates up to ½ megabyte of main memory, and direct memory access channels for input/output. As many as ten user stations can be supported, with five I/O ports standard. Optional battery back-up for main memory is also available. Software includes general accounting; property management; medical billing; travel agency management; florist accounting; service station management; and general contractor job costing. Prices start at $18,000. MicroFive Corp., 17791 Sky Park Circle, Irvine, CA 92714.
CIRCLE INQUIRY NO. 269

Cataloging disk files for the TRS-80 model I, the Flopycat/Bas, combines the speed of machine language modules with the ease of modification allowed by Basic, and is designed to run under DOS 2.3 although any compatible disk's directory may be read. Twelve useful program options, including safe exits to Basic and DOS, allow building, maintaining, and listing catalog files of even the largest disk collections. Fast video based file maintenance saves paper and print time when doing routine updating of catalog files, and the print option produces two well formatted reports. The program and operator's manual is available on formatted diskette (or cassette, upon special order) for $30. Marvin W. Plunkett, 1641 Northwest Rutter Lane, Roseburg, OR 97470.
CIRCLE INQUIRY NO. 270

Z-80 monitor in a single voltage 2716 Eprom allows operators to display, substitute or fill memory; perform hexidecimal arithmetic; establish two program breakpoints; set and examine registers; assign I/O devices; input and output from or to an I/O port; and offers other capabilities permitting board level programming. Built-in scanning enables the monitor to quickly review the remaining memory capacity and properly set its stack so the Eprom monitor doesn't have to be replaced or reprogrammed as users add or subtract RAM memory. Price: $89. SSM Microcomputer Products, 2190 Paragon Dr., San Jose, CA 95131.
CIRCLE INQUIRY NO. 271

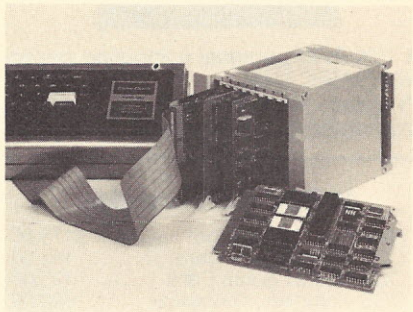
Program to check spelling in documents prepared with word processors and text editors, Spellguard, checks a 10,000-word document (20 pages) for spelling and typographical errors in under one minute. It checks spelling using a dictionary containing 20,000 of the most commonly used words in the English language, and is easily expanded by users. Maximum dictionary size is limited only by maximum disk file size. Users with the new hard disk systems could have up to one million separate words. A special feature creates multiple, personalized dictionaries, number unlimited, in any language using a Roman alphabet. Price: $295. Innovative Software Applications, Box 2797, Menlo Park, CA 94025, (415) 326-0805.
CIRCLE INQUIRY NO. 272

Advanced dot matrix printers, the MX-80, features numerous cost/performance breakthroughs that contribute to its extensive capabilities and extraordinarily low price: less than $650. It has a disposable print head, conservatively rated between 50 and 100-million characters, that you can snap out and throw away. A new one costs less than $30 and can be installed with one hand. The system prints a full character set, in up to twelve print modes, of which more than half utilize multi-strike and/or multi-pass techniques to generate correspondence-quality printing. It prints bidirectionally at 80



cps, with a logical seeking function to minimize print head travel time and maximize throughput. Epson America, Inc., 23844 Hawthorne Blvd., Torrance, CA 90505.
CIRCLE INQUIRY NO. 273

STD bus interface for TRS-80 and S-100 can be used as a low cost development system for STD bus products to expand hardware I/O capability through direct interface with other STD bus cards for A/D, D/A, and industrial control. Applications may be assembled and edited on a floppy disk or cassette based system, then transferred



directly into the STD bus for execution and debug. Introductory price of $260 includes the circuit board with the 2K byte DDT-80 ROM plus the interface cable for connecting directly to either the TRS-80 keyboard or expansion interface. QC Microsystems, P.O. Box 401326, Garland, TX 75040.
CIRCLE INQUIRY NO. 274

Multiuser, multitasking disk operating system, Cromix, was developed to take advantage of the large amount of RAM and hard disk storage available on Cromemco computers. The system supports multiple tasks and multiple users on hard disk and floppy disk storage systems; multiple hierarchical directories and subdirectories; compatible I/O which supports user redirection of input and output; a versatile Shell program for flexible and reconfigurable user interface; a password security system, limiting system and file access, as well as protecting files with read, write, append, and execute attributes; date and time support; numerous file buffers for high speed execution; and resident, swapping-free execution of tasks and servicing of users through bank selection for rapid context switching. Cromemco Inc., 280 Bernardo Ave., Mountain View, CA 94043, (415) 964-7400.
CIRCLE INQUIRY NO. 275

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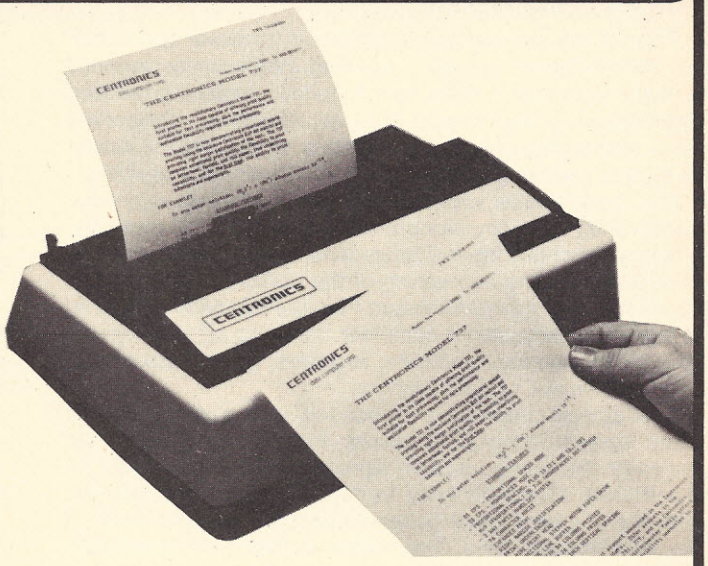

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BOOK REVIEWS

8085A Cookbook
by Christopher Titus, Jonathan Titus and David Larsen
Howard W. Sams, Indianapolis, IN

Reviewed by Dennis Doonan

This volume is a practical handbook of hardware design with the 8085A microprocessor. It assumes a minimum background in digital electronics, but is easy to follow, containing detailed descriptions of the design process, examples, component data, timing diagrams and schematics. It enables the reader to design a working 8085A-based microcomputer system.

The book begins with a presentation of basic microprocessor and microcomputer concepts and an 8085A overview. It clearly describes internal operations, timing, system busses, control signals and addressing of the 8085A. The text introduces the ideal microprocessor; then the 8085A is compared to this. The discussion is complete, including program execution, binary numbers and data, registers, flags, instructions, and input/output communications.

The design process is introduced with a discussion of basic system control. It follows the steps necessary to generate the needed system signals from those available on the 8085A. Cost/efficiency tradeoffs are detailed, starting with the on-board clock generator and the demultiplexing of the address/data lines. The reader is able to start creating simple designs immediately.

Three chapters deal with the types of memory, memory design, and address decoding used.

A chapter on interfacing describes connection of I/O ports to the microprocessor. I/O operation is discussed with the 8085A's internal serial I/O capacity and the use of external devices that function as complex I/O ports.

Since the 8085A was created with a family of support chips that allow easy design of 3 or 4 chip systems, these are described in detail. Included are the 8185 read-write memory, the 8355 ROM with I/O, and the 8155 RAM with I/O and timer. Decoding, addressing, and suggested uses are fully explained.

The final chapter draws together all these topics, relating them to specific examples in designing a system. Several appendices round out the book.

350 pages $12.95

Microprocessor Software Design
by M. Schindler
Hayden Book Co., Rochelle Park, NJ

Reviewed by David Marca

Clearly, system programmers are the intended readers of this book, as the topics pertain to instruction sets, operating system principles and I/O interfacing. A small percentage of application programmers with high performance needs (i.e., real-time applications) will also find the material beneficial.

The most important aspects of critical design are the constraints imposed by the real world upon a desired set of functionality. The set of design constraints covered is fairly extensive and quite current, since the book is composed of some 45 individual technical papers. This collection of recently published papers covers a wide spectrum including target language selection, operating system fundamentals and selection, software development strategy and techniques, hardware organization and its physical constraints, measuring system performance, microcoding techniques and development tools. The technical depth of each paper varies from very general to moderately detailed. The reader should be

prepared to gather ideas in more detail from other sources.

Technical papers, drawings, schematics, flowcharts and tables, are well-orgainized and provide a good overview. For those building software very close to the machine level, or with critical machine constraints, the book can help recall vital constraints affecting final software quality.

224 pages $9.95

6502 Software Design
by Leo J. Scanlon
Howard W. Sams, Indianapolis, IN

Reviewed by Roger H. Edelson

Zeroing in on the software aspects of the 6502 microprocessor, a descendant of the Motorola line, this book takes a historic vantage point, then proceeds to a detailed view of the processor instruction set. In an orderly manner, the reader is introduced to more complex considerations in 6502 assembly language programming. We are led through subroutines, list and table processing, and relatively complex input/output programs that can be handled by the novice.

The section on 6502 assembly language programming is excellent; explanations of the 13 addressing modes available are particularly good. There is, however, confusion over the use of symbols "K" and "k"—"K" stands for 1024 bytes and "k" for 1000 of anything. The author is even somewhat unsure of which convention to use—on page 17 it is 1024 and on page 38 it's 1000.

The book provides all the reader needs to know to start this specialized type of programming.

288 pages $10.50

Digital Compiler Simulation
by Fred J. Maryanski
Hayden Book Co., Rochelle Park, NJ

Reviewed by Rocky Smolin

This book provides the foundation for understanding the principles and purposes of system simulation, with detailed explanations of the software that makes it possible.

The style is not "friendly"—it assumes some high-level programming language experience as well as mathematical sophistication. Simulation experiments most often model stochastic systems, those characterized by random variables. The results are expressed in terms of probability functions.

However, the author presents a complete discussion of modeling and simulation—not only how to specify, design, code, debug, analyze, validate and interpret your simulation experiment, but also detailed descriptions of four.

Modeling of discrete systems is best accomplished through GPSS and Simscript, and the two chapters that follow detail the workings of these two languages. Two chapters on probability and statistics in simulation and the design and analysis of simulation experiments are followed by a discussion of the modeling and simulation of continuous systems. Using the two other simulation languages—CSMP and Dynamo—the author explains how continuous systems are modeled based on series of simultaneous equations.

Although best suited to persons making a vocation of technical, mathematical, or scientific pursuits, the book's usefulness to those engaged in microprocessor applications should not be underestimated. The simulation languages described, because of size and complexity, are most often implemented on large mainframe computers. However, the clear and complete explanation of these principles could lead the curious reader to simulation routines written in Basic for microprocessors. Perhaps this book will give him access to this fascinating world.

328 pages $15.95

CALENDAR

Mar 23-25 1981 Office Automation Conference, Albert Thomas Convention Center, Houston, TX, seminars on all phases of office automation including feasibility studies, organizational impact, systems architecture, electronic mail, teleconferencing, merger of voice with text and data, multi-function workstations, technical switching technology, word processing. AFIPS, Office Automation Conference, Box 9659, N. Lynn St., Arlington, VA 22209, (703) 558-3600.

Mar 24-26 Southwest Computer Conference, Myriad Convention Center, Oklahoma City, OK, seminars on energy, office and manufacturing of the future and communications. Over 100 mini, micro, main-frame, software manufacturers represented. E.Z. Million, Box 950, Norman, OK 73070, (408) 245-6870.

Mar 24-26 SSE '81, Southwest Semiconductor Exposition, Civic Plaza Convention Center, Phoenix, AZ, exhibits of semiconductor, hybrid, and printed circuit board production, processing, and test equipment. Cartlidge & Assoc., 491 Macara Ave., Suite 1014, Sunnyvale, CA 94086, (408) 245-6870

Mar 24-27 Printemps Informatique, Talis des Congres, Paris, France, data processing exhibition for OEMs including data entry devices, terminals, transmission equipment and accessories. Kallman Assoc., 30 Jounal Square, Jersey City, NJ 07306, (201) 653-3304.

Mar 31-Apr 2 Cincinnati Business Show, Convention-Exposition Center, Cincinnati, OH, exhibitions of automated systems, communications, computers, telephone systems, word processing, data processing, supplies, printing equipment, furniture, bindings, graphics forms. Weber & Assoc., 5679 Creek Rd., Cincinnati, OH, 45242, (513) 531-5959.

Apr 1-2 Southwest Printed Circuits & Microelectronics Exposition, Market Hall, Dallas, TX, manufacturing exhibits and displays geared to regions of Texas, Oklahoma, Arkansas, Louisiana, and New Mexico. Also held Apr 15-16 at Sheraton Twin Towers Convention Center, Orlando, FL for southeastern regions. Industrial & Scientific Conference Mgmt., Inc., 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

Apr 1-8 Hanover Fair '81, Hanover, Germany, exhibitions of microcomputers, word processors, data processing and office equipment. Interface Age will exhibit in Oebit-Nord (Hall 1), Stand A-503. Hanover Fair Information Center, P.O. Box 338, Whitehouse, NJ 08888, (201) 534-9044, Telex 833493.

Apr 3-5 West Coast Computer Faire, Civic Auditorium, San Francisco, CA, seminars on interesting microcomputer applications and projects and wide range of equipment exhibitions. Computer Faire, 333 Swett Rd., Woodside, CA 94062, (415) 851-7075.

Apr 7-9 Electro/81 Film Theater, New York, NY, showing recent and notable engineering and general science films for an audience of technical executives. Dale Litherland, Suite 410, 999 N. Sepulveda Blvd., El Segundo, CA 90245.

Apr 28-30 International Telecommunications Forum, Concorde Lafayette Hotel, Paris, France, discussing strategies for suppliers and users in new telecommunication products and services. Dusty Rhodes, Arthur D. Little Decision Resources, Acorn Park, Cambridge, MA 02140, (617) 267-3456.

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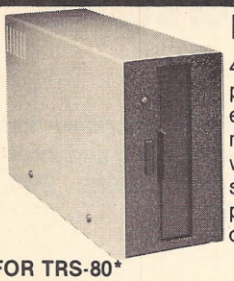

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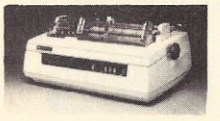

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Free Literature

Small business computer guide describes the advantages of owning a desk-top accounting and information system. Pertec Computer Corp., Dept. 200, Box 4095, N. Hollywood, CA 91607.

CIRCLE INQUIRY NO. 200

Capacitor catalog provides an overview of product line of film foil, metallized film, mica and aluminum electrolytic. Acushnet Capacitor Co., 720 Bellville Ave., New Bedford, MA 02741.

CIRCLE INQUIRY NO. 201

Switch supplies and implements for PC and panel mounting are listed in a catalog. Switch supplies are available in a subminiature form in 1, 2, or 4 poles employing today's standard 0.1 inch mounting centers. Alco Electronic Products, 1551 Osgood St., N. Andover, MA 01845.

CIRCLE INQUIRY NO. 202

Electronic packaging and breadboarding products are described in a 12-page brochure. Included are interface boards, plugboards, motherboards, cases, tools, wiring terminals and kits. Vector Electronic Co., 12460 Gladstone Ave., Sylmar, CA 91342.

CIRCLE INQUIRY NO. 203

Science fair comic book is a full-color educational aid. In addition to news about coming events and space exploration, the comic features topics on energy and the importance of computers in science, business, and everyday life. Radio Shack, Educational Comic Book Program, 1300 One Tandy Center, Ft. Worth, TX 76102.

CIRCLE INQUIRY NO. 204

Applications software is detailed in three catalogs, including programs for the Apple II, Apple II Plus, TRS-80 and TI 99/4 computers. Applications include office management, accounting and financial management, and professional applications. Charles Mann & Assoc., Micro Software Div., 7594 San Remo Trail, Yucca Valley, CA 92284.

CIRCLE INQUIRY NO. 205

Splice connector systems are described in a 12-page brochure, including multi-power and in-line devices. Descriptions, specifications and applications for each connector type are provided. Viking Connectors, 21001 Nordhoff St., Chatsworth, CA 91311.

CIRCLE INQUIRY NO. 206

Thumbwheel, leverwheel and pushwheel switches are detailed in a 32-page catalog. In addition to engineering drawings and specifications on 23 types of switches, introductory information covering basic operating principles is included. Cherry Electrical Products, 3600 Sunset Ave., Waukegan, IL 60085.

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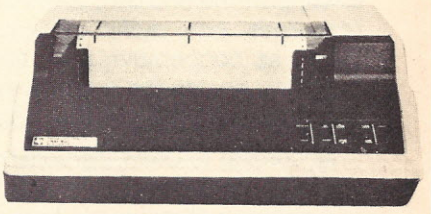

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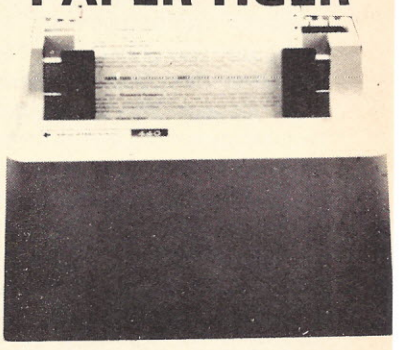

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Continued from page 93

These systems integrators, numbering about 4,000 nationwide, not only provide packages but also do the "handholding" and training to get the first time personal computer user up and running.

"It is important for a company our size not to attempt to support the end user on a direct basis, but to put our resources into more effective uses," says Dean, "such as cooperative advertising and developing the tools that enable the systems integrators and computer retailer/OEM to better their jobs.

According to Dean, personal computer manufacturers who are considering opening their own retail outlets are making a mistake due to the tremendous amount of support required. "The market—both home and industrial combined—just does not justify it," he says.

According to James Pike, new business manager at Ohio Scientific, the basic strategy of his company is dependence on the OEM over the short term, but positioning its product line with offerings at the low end—personal computers—and at the high end—with minicomputer like offerings. "This will allow us to expand in whatever direction the market develops," he says.

At present Ohio Scientific conducts what amounts to two separate market efforts oriented toward different end users. The company's high end systems are aimed at the small to medium business organizations and are marketed through independent sales organizations around the country. At the low end, its desktop personal computer is marketed through retail computer stores.

In both cases, Ohio Scientific is increasing its emphasis on the OEM, be it a system integrator or a specialized computer retailer. "In order for the personal computer market to expand enough to support the number of companies that now exist," he says, "the existence of some sort of intermediaries who are application specialists is vital."

In fact, says Pike, the personal computer market is so wide at the low end that manufacturers or groups of manufacturers cannot hope to be expert enough to serve all the specialized applications that exist. "So the intermediary specialist, call him what you will—OEM, computer retailer, systems integrator—will always perform an important role for the computer manufacturer," he says.

And as more and more large personal computer manufacturers move into the market to serve the mainstream "vanilla" applications, says Pike, the computer retailers will tend more and more to migrate toward specialties in which they will serve as personal computer OEMs.

Paralleling this trend, Pike predicts, will be a move by some of the manufacturers to go after large corporate end users by forming direct sales organizations. "This sort of effort will not interfere with the existing channels, such as computer retailers, systems integrators and manufacturers' reps, but complementing them," he says. "It will represent a new user not accessible before to the personal computer manufacturer, expanding even further the customer base."

According to Mike Markkula, vice president and director of marketing at Apple Computer, his company will consider any means of marketing the end user wants. But this in part depends on the particular application and market area.

In the consumer and business market, Apple's primary focus is still on the relatively sophisticated hobbyist and professional business user. The primary means of distribution is through retail computer and office machine dealer outlets with occasional reliance on special distributors for particular applications. In the educational market, for example, Bell & Howell, the predominant firm in the educational audiovisual market, is the distributor for Apple products.

"In general our marketing strategy will be to tailor our distribution channels to make it as easy as possible for the end user to buy an Apple product," says Markkula. If a user is used to buying from a retail office supply store, he says, that is where Apple will attempt to market its products. "If he is used to buying from a manufacturer's representative who calls on him at his office, that is the way we'll tailor our distribution network," says Markkula.

Beyond these general statements of intention, Markkula is reticent about Apple's future marketing strategy. But according to personal computer industry analysts, from the way Apple is positioning itself in the marketplace, its intentions seem clear.

In the small business segment, the focus will be on the million or so small firms who need the services of a small computer to manage their daily operation. In the professional segment, the focus is on the so-called "office of the future." In both cases, while the end user is the corporation which buys several such systems, the actual users are the individuals employed by the organizations. To reach these markets, analysts say, Apple will depend primarily on its existing distribution channels, but test the small business distribution channels.

In the home computer market, these analysts say, Apple's main strategy appears to be to let competitors such as Texas Instruments, Radio Shack, Commodore and Atari spend the time and money necessary to educate the potential customer base and then introduce a "next generation" low end product that is lower in cost and more powerful than its competitors when the market begins to take off.

In the industrial market, analysts look for Apple to either establish its own direct sales force and/or make use of existing electronics oriented stocking distributors as well as manufacturer's reps similar to its B&H relationship. There will also be an effort to develop the OEM portion of this market.

According to Markkula, the industrial market represents a significant opportunity for the makers of personal computers.

"The classical suppliers to this market have been the semiconductor manufacturers who offer stripped down single board computers for sale and use in large systems," he says. "But no longer. I think we will see several personal computer makers begin to develop marketing efforts in this area during the next year or so."

Other than H-P, says Markkula, no one else in the personal computer market is making a significant effort, with its own direct sales force. For other manufacturers, the OEM will play an important role, he says, until the level of sophistication among end users has increased. "Once that occurs the method of distribution will be much easier and straightforward," he says. □

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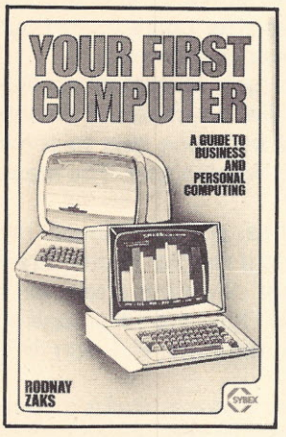

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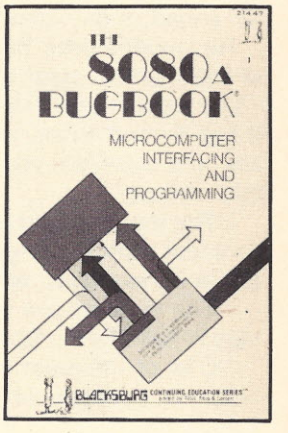

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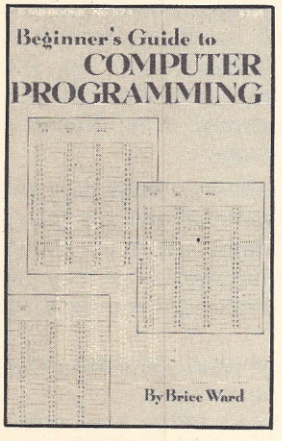

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Continued from page 68

maintain your equipment. Thirdly it lets a progressive company keep up with the state-of-the-art. Technology is growing so fast in this industry, equipment in vogue today can be obsolete tomorrow. Leasing gives the company the flexibility to jump into any new higher speed equipment without penalty.

Terminal Systems will also custom-design a system. Littlefield describes one he worked out for travel agents: "Working together with American Airlines, Eastern and TWA, a teleticketing reservation service was developed for lease to travel agents with a terminal and a printer.

"The travel industry always had the chore of manually writing a ticket for a traveler after confirmation by the airline. A long itinerary, say 6, 7, 15 different stops, took a long time to write up by hand and could cost a stiff wage. With the leased computer system it costs 50¢—regardless of the number of stops. The ticket goes directly from the airline's terminal to the travel agent's printer...to the traveler. This advantage of lowering end costs allows a marginal business to stay far ahead of its competitors.

He underscores his meaning by highlighting a few of the markets best served by leasing arrangements: "The educational field finds it particularly beneficial. It has limited funds allocated and schools only operate nine months a year. When June comes by, they go into storage.

"The medical field is in a state of flux. A lot of laboratory test work is being sent to central computer banks... EKGs for example...and sending back bone fide results.

"The legalists are setting up huge data base search files to help them prepare briefs and defense procedures.

"One of the most unusual to come up recently was Notimex, the Mexican news agency, which is setting up leased terminals in cities across the U.S. It began by owning its own systems. But when the equipment went down, it took three days to get it restarted. For a news agency, this is intolerable.

"With leased equipment, a faulty terminal can be working in three hours after one phone call. Notimex is the only foreign-language broadcaster setting up equipment in American stations, gathering the news, and sending it out over its own net in Spanish. The other big news bureaus (Reuthers, Tass) only send news in to the U.S."

George Ryan, chairman and chief EO for Cado Systems Corp. in Torrance, CA, sells micros. But he is knowledgeable on all three computing methods and unblushing in his preference...and opinions:

"Outright purchase is certainly the cheapest way to go for companies well capitalized. You get accelerated depreciation and investment tax credit. But for the small, undercapitalized businessman ($500,000 to $1,000,000) third party leasing is certainly the way to go. They are crazy not to. Even with the prime at 20%. He can get a return on his investment that far outweighs the interest cost. Last year when the crunch came, small businesses, in particular, slowed down buying and leasing. It was nonsense because costs continue to rise...but the need to automate was still there.

"What you are really doing when you automate (buy a computer) is trying to better manage your business... reduce the day's sales outstanding and receivables. Or you're going to reduce the number of overtime hours you're paying Suzi to straighten out a bookkeeping mess manually. One or two points higher in the prime is irrelevant."

Why does a small businessman need a computer? "Very simple. He lives in chaos. He is the one who by definition has bought a gas station, opened a store, drills teeth, whatever. He does those things pretty well. But he's not an accountant. He doesn't know debits from credits. Typically what happens is that he worries...works nights and days after hours to sort out the bills. He's not dumb, simply not informed.

"Unfortunately he tends to look at something like the prime and shudders. We live in chaos. It is the norm. As a people we look for someone else to solve our problems. We can't look to Washington. The mess is international.

"What he should say is 'I've got to manage my business. And if I stop managing it well for two or three points I'm crazy. My competitor down the street isn't going to do that. So why should I not take advantage of all of the management tools available if I can off-balance-sheet finance it.'

"So I'm strong for leasing for undercapitalized companies. All have purchase options at the end so you're able to recapture a good percent of what you've paid in.

"You can buy a small computer today including software for about $15,000. Even at today's interest rates, it runs to about $2.50 an hour. My god, you can't hire anyone for $2.50 an hour. Even in today's climate I would urge every small businessman to automate as quickly as he can. He will get the benefit immediately; cost will be marginally higher but is tax deductible. It's crazy not to go. You're talking pennies per hour."

When it comes to time sharing, Ryan is logical and pessimistic: "It's on very shaky legs. I know that the business seems to be doing well, but the erosion of its customer base will continue. If that wasn't so, you wouldn't have people like ADP going into the computer business. It is going to sell hardware. Why? Because it's going to lose its base if it doesn't.

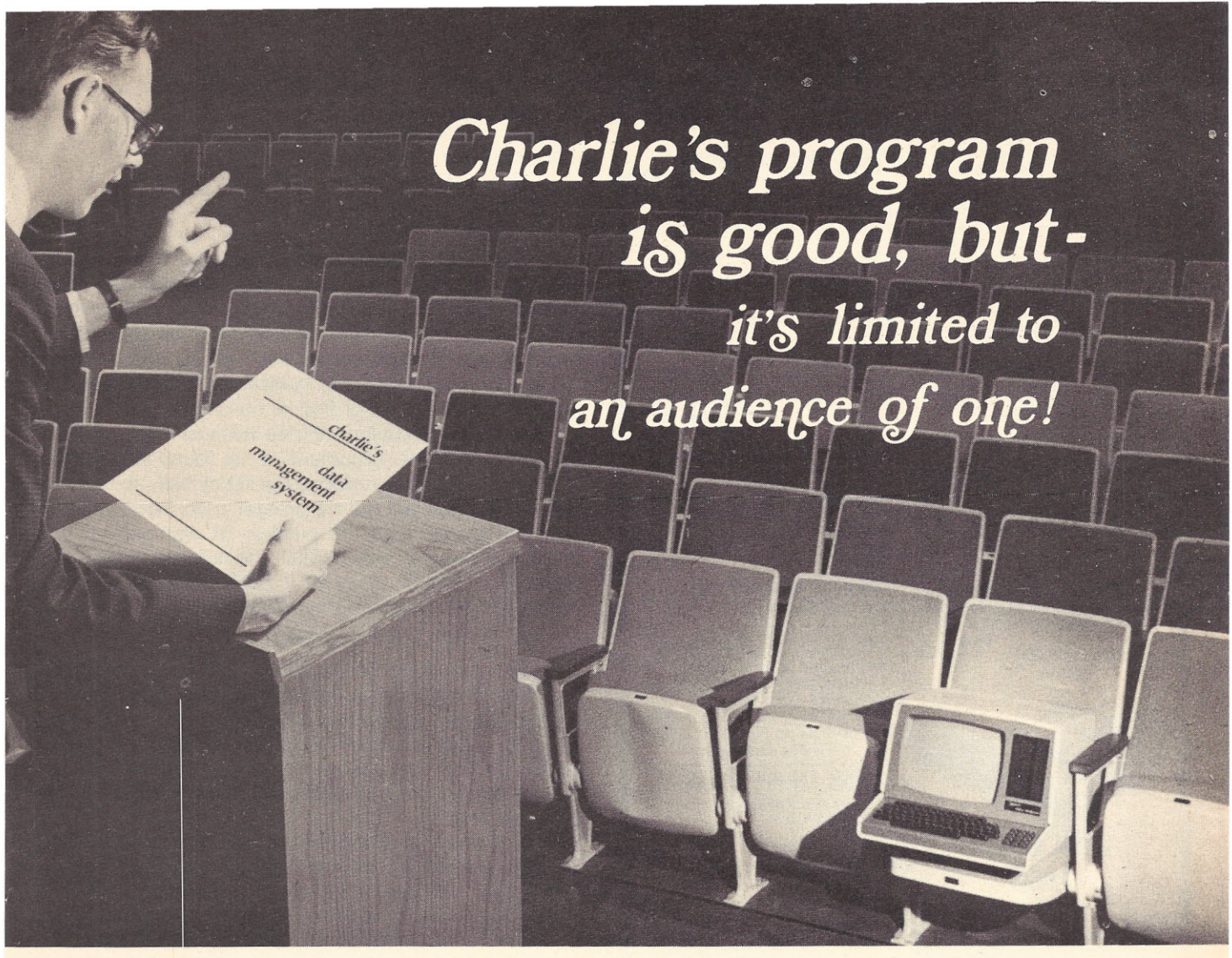
"There are two types of time sharing: batch type and on line (where the guy has a terminal and a printer). Both are vulnerable to small systems, which are simple to use, and far more powerful in terms of what they can deliver. It's going to be very difficult for the big CPU guys to beat.

"Xerox sells full accounting services. So does a division of ADP. But they are very expensive.

"The line time is going to start killing customers. Line rates are going sky high. ATT is being forced to raise rates. The multibillion corporations will turn to their own small systems; the time sharers will have to start selling them. ADP already has a deal with Rexon to sell private label computers.

"Time share will just sort of fade away...not propitiously. Nothing starts and stops immediately...things happen gradually. Small systems are only going to be small in size—not in power. A 2-ft cube will be like a 360. It's already happening. IBM has this small thing that's the most powerful system it's ever produced.

"And there is a prestige appeal to owning your own computer. We run Cado, a $50 million company, on the same software we put in the little CAT. If we can run this company, a guy can run a half-million, million dollar enterprise without changing a code."□



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Continued from page 72

An example of a use of this function is:

```
(* set ARGUMENT *)
INDEX : = BINARY_SEARCH(ARGUMENT);
IF INDEX > 0 THEN
    DO_FIND
  ELSE
    DO_NO_FIND;
```

In order to visualize this technique, the program Binserch can be executed. This will display even numbers between 10 and 60. The program will prompt for a number to find. The numbers in the range being checked will be displayed at each guess with pointers to 'lo', 'hi', and 'mid'. The number of tries will display along with the notice of find or no-find.

Analysis of the number of tries involved in this method is again easy if the 'argument' is not found in the array 'salesman'. Each try reduces the list by half, so that the number of tries will not be greater than that power of two just bigger than the number of elements in the array. For an array size of 100, the number of tries will be no more than 7, since $2^7 = 128 > 100$. This can be calculated by using the Pascal statement:

```
MAX_TRIES : = trunc(1n(NENT) + .5)
```

For the case when the 'argument' is found, it's safe to say that it was found no more than 'max_tries'.

This has more code to execute but requires very few tries to establish whether or not an array contains some value. For relatively large arrays (nent > 20), the binary search is much faster than the sequential exhaustive search.

The choice of method for search will first depend on whether or not the elements can be ordered. If no order is possible, the only choice is the sequential search.

Even when a list can be ordered, it is sometimes desirable to use sequential searching with the list in a special order based on some special knowledge about the probabilities each element will be sought.

If all elements have equal probability of being sought and the elements may be ordered, the choice will depend on the size of the array.

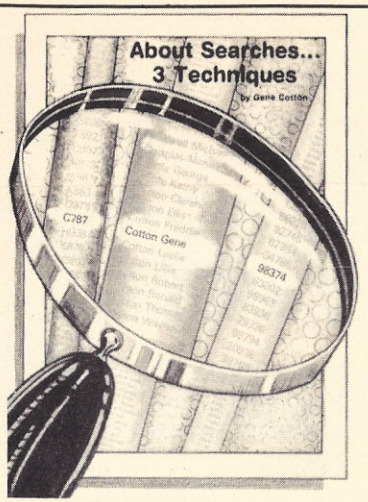
The following table of expected number of tries for each method is used for comparison:

	Sequential		
NENT	**find**	**no-find**	**Binary**
5	3	5	3
10	5	10	4
15	8	15	4
20	10	20	5
30	15	30	5
50	25	50	6
100	50	100	7
500	250	500	9
1000	500	1000	10

The superior algorithm of the binary search proves more effective than the speed of the simpler sequential at larger list sizes.

Small lists (nent < 20) are best searched with the sequential exhaustive search and large lists (nent > 20) are best searched for with the binary search.

Actually the break-even point is not that well defined. The rule can be modified to read: small lists (nent < 10) use sequential, large lists (nent > 30) use binary, medium size lists, try both. □



Program Listing

```
program binserch;

const nent=26; (* Number of entries in the array box *)
      FF=12;   (* The character which causes a clear screen *)

var arg,      (* What is to be searched for *)
    i,        (* working index *)
    line,     (* Console print line index *)
    tries     (* number of attempts in find *)
          : integer;
    box       (* Contains things to be looked up *)
              (* arg & box must match in type *)
          : array[1..nent] of integer;

procedure initialize; (* Set up box with values *)

 var i : integer;

 begin
  for i := 1 to nent do box[i] := 8 + 2 * i
 end;

procedure clrscrn;  (* clear screen, home & set line *)

 begin
  write(chr(FF)); (* Form Feed clears screen *)
  line := 0
 end;

procedure prtbox(low,high:integer); (* prints range of box *)

 var i : integer;

 begin
  gotoxy(3*(low-1),line);
  for i := low to high do
    write(box[i]:3)
 end;

procedure prtline(low,mid,high:integer); (* prints with pointers *)

 var i : integer;

 begin
   prtbox(low,high);
   writeln;
   line := line + 1;
   gotoxy(3*(low-1)+1,line);
   write('^');
   gotoxy(3*(mid-1)+1,line);
   write('^');
   gotoxy(3*(high-1)+1,line);
   write('^');
   line := line + 1
 end;

function search(arg:integer):integer; (* This is the Binary Search *
 var low,high,mid : integer;
 begin
  tries := 0;
  line := 2;
  low := 1;
  high := nent;
  repeat
   mid := (low + high) div 2;
   prtline(low,mid,high);
   tries := tries + 1;
   if arg < box[mid] then
      high := mid - 1
     else
      low := mid + 1
  until (high < low) or (arg = box[mid]);
  if arg = box[mid] then search := mid else search := 0;
  writeln; writeln
 end;

begin          (* Main *)
 initialize;
 clrscrn;
 prtbox(1,nent);
 repeat
  line := 0;
  gotoxy(0,22);
  writeln('What number shall we search for?');
  write('(-1 to exit program) ');
  read(arg);
  clrscrn;
  if arg >= 0 then
    begin
     i := search(arg);
     gotoxy(1,line+3);
     if i = 0 then
        write(arg:3,' not found')
      else
        write(arg:3,' found at entry',i:3);
     writeln('   (in',tries:2,' tries)')
    end
 until arg < 0
end.
```

Textwriter

Continued from page 108

Program listing

```
10 REM "TEXT" A TEXTWRITER PROGRAM    BILL RICHTER
20 REM                                VICTORIA MICRO DIGITAL
30 REM                                401 DUNDEE STREET
40 REM                                VICTORIA TX 77901
41 REM
42 REMEMBER IF MEMORY IS SMALL - MINIMIZE REMARKS
43 REM
50 T=24\REM 24 LINE CRT
60 H$=CHR$(26)\REM CLEAR SCREEN CHAR
70 !H$,\!"TEXTWRITER  VER 3.1  VICTORIA MICRO DIGITAL"
80 DIM E$(2+(80+2)*66)\REM SIZE OF BUFFER  66=LINE LIMIT
90 DIM S$(80)
100 LINE 81\REM TELL BASIC MAX LINE LENGTH
110 !\!"OPTION LIST"\!
120 !"I=INSTRUCTIONS"
130 !"N=NEW TEXT"
140 !"E=EDIT TEXT"
150 !"P=PRINT"
160 !"S=SAVE TEXT ON DISK"
170 !"L=LOAD TEXT FROM DISK"
180 !"D=DESTROY FILE ON DISK"
190 !"O=OPTION LIST"
200 !"B=RETURN TO BASIC"
210 !\INPUT"TYPE OPTION LETTER AND RETURN.....",T$
220 IF T$="D" THEN 1990
230 IF T$="I" THEN 320
240 IF T$="N" THEN 750
250 IF T$="E" THEN 1650
260 IF T$="P" THEN 1720
270 IF T$="S" THEN 1770
280 IF T$="L" THEN 1900
290 IF T$="O" THEN 110
300 IF T$="B" THEN 2100
310 GOTO 210
320 !H$\REM CLEAR
330 !"THIS TEXTWRITER IS USED TO WRITE AND SAVE LETTERS (OR ANY OTHER TEXT)."
340 !"THE ENTRY IS FREE FORMAT JUST LIKE A TYPEWRITER.  WHAT YOU SEE ON THE"
350 !"SCREEN IS WHAT YOU GET.  USE THE CURSOR CONTROL ARROWS, LINE FEED AND"
360 !"CARRIAGE RET. KEYS TO MOVE AROUND THE SCREEN FOR EDITING AND CORRECTING"
370 !"ERRORS"
380 !
390 !"NORMALLY YOU WILL START WITH THE N=NEW TEXT OPTION.  IF YOU ARE FINISHED"
400 !"OR PARTLY FINISHED AND YOU WANT TO SAVE TEXT ON DISK OR PRINT IT, YOU"
410 !"MUST GET BACK INTO OPTION COMMAND MODE BY HOLDING THE (CTRL) KEY WHILE"
420 !"PUSHING THE LETTER (O).  TO SAVE THE TEXT USE THE S=SAVE OPTION.  TO"
430 !"PRINT USE THE P=PRINT OPTION.  TO RECALL SAVED TEXT FROM THE DISK USE"
440 !"THE L=LOAD OPTION.  ONCE THE TEXT IS LOADED IT MAY BE PRINTED OR CHANDED"
450 !"WITH THE E=EDIT OPTION."
460 !
470 !"ANY COMBINATION OF THE ABOVE COMMANDS MAY BE USED.  BE CAREFULL NOT"
480 !"TO DESTROY YOUR ENTRY BEFORE YOU SAVE IT BY ACCIDENTALLY DOING AN"
490 !"N=NEW COMMAND.  THE N COMMAND ALWAYS CLEARS OUT ALL OLD TEXT."
500 !
510 !"FOR HELP TYPE THE LETTER O TO RETURN TO THE OPTION LIST."
520 !\!\!
530 GOTO 210
540 REM
990 IF T$=CHR$( 8) THEN 1430
1000 IF T$=CHR$(11) THEN 1500
1010 IF T$=CHR$(10) THEN 1570
1020 IF T$=CHR$(15) THEN 2080
1030 IF T$<CHR$(32) THEN 1170
1040 IF T$>CHR$(126)THEN 1170
1050 REM
1060 REM ##### FILL ROUTINE #####
1070 REM
1080 IF C=N+1 THEN 1170
1090 X=2+C+((N+2)*(L-1))\REM NOW PUT IT IN THE BUFFER
1100 E$(X,X)=T$
1110 !T$,\REM ECHO CHAR ON CRT
1120 C=C+1
1130 GOTO 960\REM NORMAL PATH - GO GET ANOTHER CHARACTER
1140 REM
1150 REM ##### ERROR RING BELL #####
1160 REM
1170 !CHR$(7),\GOTO 960
1180 REM
1190 REM ##### CARRIAGE RETURN #####
1200 REM
1210 IF L=S THEN 1170\REM ERROR BELL
1220 X=L*(N+2)+1
1230 IF L1=T AND F=0 THEN !E$(X,X+N+2), ELSE !
1240 L=L+1
1250 IF L1<T THEN L1=L1+1
1260 C=1
1270 IF L>T AND L1=T THEN 1290
1280 GOTO 960
1290 !CHR$(30),\REM PRINT MESSAGE ON TOP LINE AFTER SCROLL OFF
1300 !"BOTTOM =",L,"    LINES REMAINING =",S-L,"    ",
1310 !CHR$(27),CHR$(61),CHR$(55),CHR$(32),\REM RESTORE CURSOR BOTTOM LINE
1320 GOTO 960
1330 REM
1340 REM ##### RIGHT #####
1350 REM
1360 IF C=N+1 THEN 1170
1370 !CHR$(12),
1380 C=C+1
1390 GOTO 960
1400 REM
1410 REM ##### LEFT #####
1420 REM
1430 IF C=1 THEN 1170
1440 !CHR$(8),
1450 C=C-1
1460 GOTO 960
1470 REM
1480 REM ###### UP ######
1490 REM
1500 IF L1=1 THEN 1170
1510 !CHR$(11),
1520 L=L-1\L1=L1-1
1530 GOTO 960
1540 REM
1550 REM ##### DOWN #####
1560 REM
1570 IF L=S THEN 1170
1580 IF L1=T THEN 1170
1590 !CHR$(10),
1600 L=L+1\L1=L1+1
1610 GOTO 960
1620 REM
1630 REM ##### EDIT #####
1640 REM
1650 !H$,\C=1\L=1\L1=1\F=0
1660 !E$(3,(N+2)*T),
```

```
550 REM ***** VARIABLES *****
560 REM
570 REM E$=EDIT BUFFER
580 REM T$=TEMP BUFFER
590 REM S$=STRING OF SPACES
600 REM R$=RETURN
610 REM L$=LINE FEED
620 REM H$=CLEAR SCREEN & HOME
630 REM C =COLUMN COUNTER
640 REM L =LINE COUNTER
650 REM N =NUMBER OF COLS
660 REM S =SIZE OF PAGE IN LINES
670 REM L1=SCREEN LINE COUNTER
680 REM F =FLAG (1=NEW) (0=EDIT)
690 REM I =INDEX
700 REM X =BUFR POINTER
710 REM T =CRT LINES
720 REM
730 REM ***** INITIALIZE NEW TEXT *****
740 REM
750 INPUT"ENTER LINE LENGTH.....",N
760 IF N<1 OR N>79 THEN 750
770 INPUT"ENTER PAGE LENGTH.....",S
780 IF S<24 OR S>66 THEN 770
790 !\!"PLEASE WAIT FOR SCREEN TO CLEAR"
800 S$=""\REM NULL STRING
810  FOR I=1 TO N
820  S$=S$+" "\REM BUILD LINE OF BLANKS
830  NEXT I
840 R$=CHR$(13)\REM CARRIAGE RET
850 L$=CHR$(10)\REM LINE FEED
860 E$=R$+L$
870  FOR I=1 TO S
880  E$=E$+S$+R$+L$\REM BUILD BUFFER FULL OF SPACES
890  NEXT I
900 F=1
910 !H$,
920 C=1\L=1\L1=1
930 REM
940 REM ******* COMMAND LOOP *******
950 REM
960 T$=INCHAR$(0)\FILL 22914,0\REM GET KEY STROKE & RESET PRINT HEAD POINTER
970 IF T$=CHR$(13) THEN 1210
980 IF T$=CHR$(12) THEN 1360
```

```
1670 !CHR$(30),\REM HOME
1680 GOTO 960
1690 REM
1700 REM ***** PRINT *****
1710 REM
1720 !#1 E$\REM THIS PRINTS THE WHOLE TEXT BUFFER PAGE STRING AT ONE TIME.
1730 GOTO 210
1740 REM
1750 REM ***** SAVE *****
1760 REM
1770 ERRSET 1770,I,I
1780 INPUT"ENTER UP TO 8 CHAR FILE NAME....",T$
1790 INPUT"IS THIS A EXISTING FILE? (Y/N)...",T1$\IF T1$(1,1)="Y" THEN 1810
1800 CREATE T$,LEN(E$)/256+1
1810 OPEN #7,T$
1820 WRITE #7,E$,N,S\REM THE PAGE SIZE N,S IS SAVED ALONG WITH THE TEXT E$
1830 CLOSE.#7
1840 ERRSET
1850 !"SAVE COMPLETE"
1860 GOTO 210
1870 REM
1880 REM ***** LOAD *****
1890 REM
1900 ERRSET 1900,I,I
1910 INPUT"ENTER FILE NAME....",T$
1920 OPEN #7,T$
1930 READ #7,E$,N,S\REM GET TEXT AND SIZE N,S
1940 CLOSE #7
1950 ERRSET
1960 !"LOAD COMPLETE"
1970 GOTO 210
1980 REM
1990 REM ***** DESTROY *****
2000 REM
2010 ERRSET 2010,I,I
2020 INPUT"ENTER UP TO 8 CHAR FILE NAME....",T$
2030 !"DO YOU REALLY WANT TO DESTROY   ",T$,"? ",
2040 INPUT" (Y/N)...",T1$\IF T1$(1,1)="N" THEN 210
2050 DESTROY T$\!"YOU HAVE DESTROYED ",T$
2060 ERRSET\GOTO 210
2070 REM
2080 !H$\GOTO 210
2090 REM
2100 !H$\END\REM RETURN TO BASIC
```

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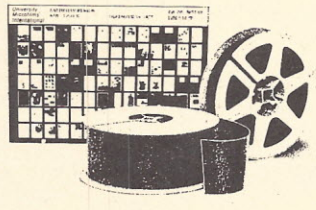

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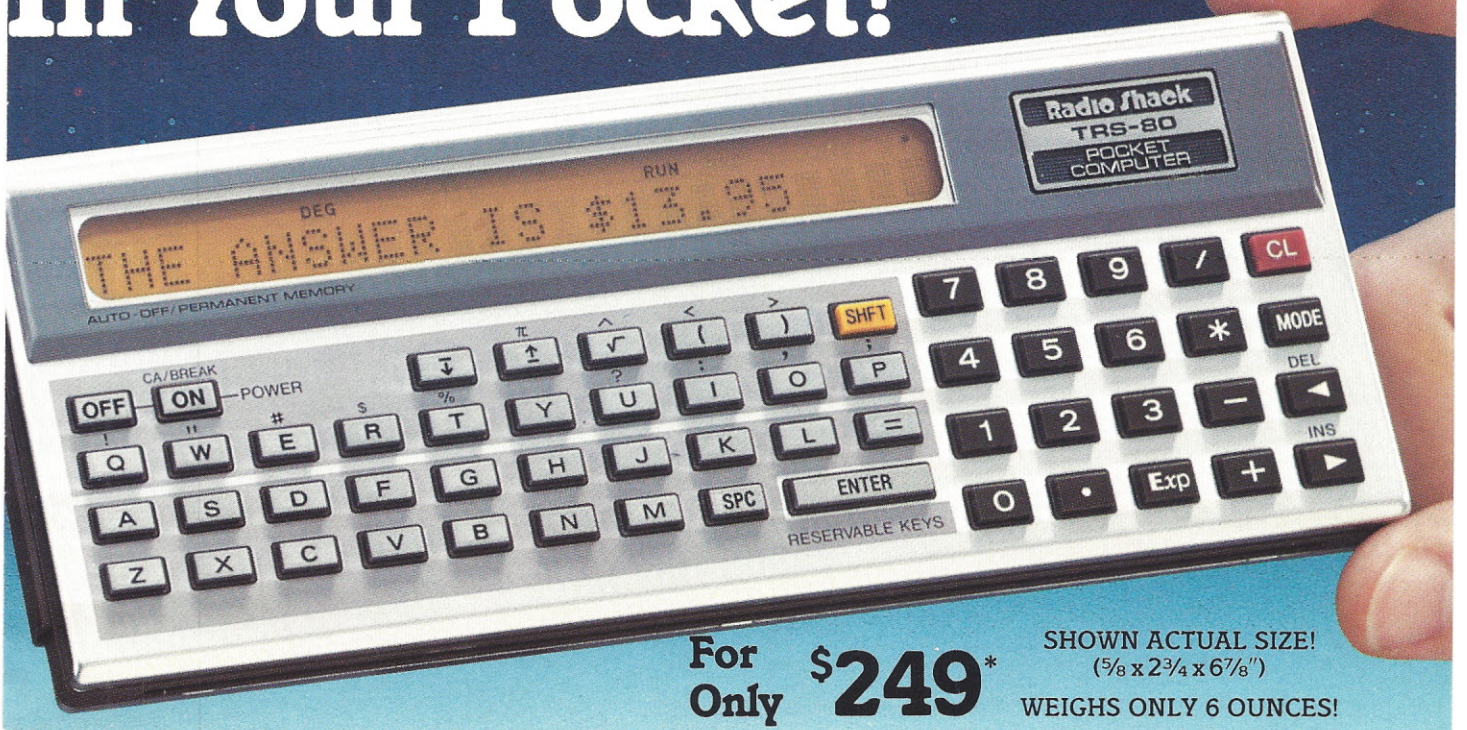

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   PAUSE "DATA ITEM #";X:INPUT A(X+100): IF A(X+100
   )<0 GOTO 25
20 NEXT X
25 M = X - 1
30 M = INT(M/2): IF M=0 GOTO 107
40 J = 1: K = X - M - 1
50 I = J
60 BEEP 1: L = I + M: IF (A(I+100)<= A(L+100))
   GOTO100
70 T = A(I + 100): A(I + 100) = A(L + 100):
   A(L + 100) = T: I = I - M: IF I<1 GOTO 100
90 GOTO 60
100 J = J + 1: IF J>K GOTO 30
105 GOTO 50
107 BEEP 5: INPUT "PRESS ENTER FOR LIST"; A
110 FOR I =1TOX - 1: J = I + 100: PAUSE "DATA ITEM #";
   USING "####"; I; " "; A (J): NEXT I
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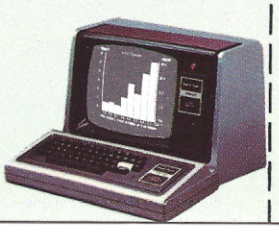

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